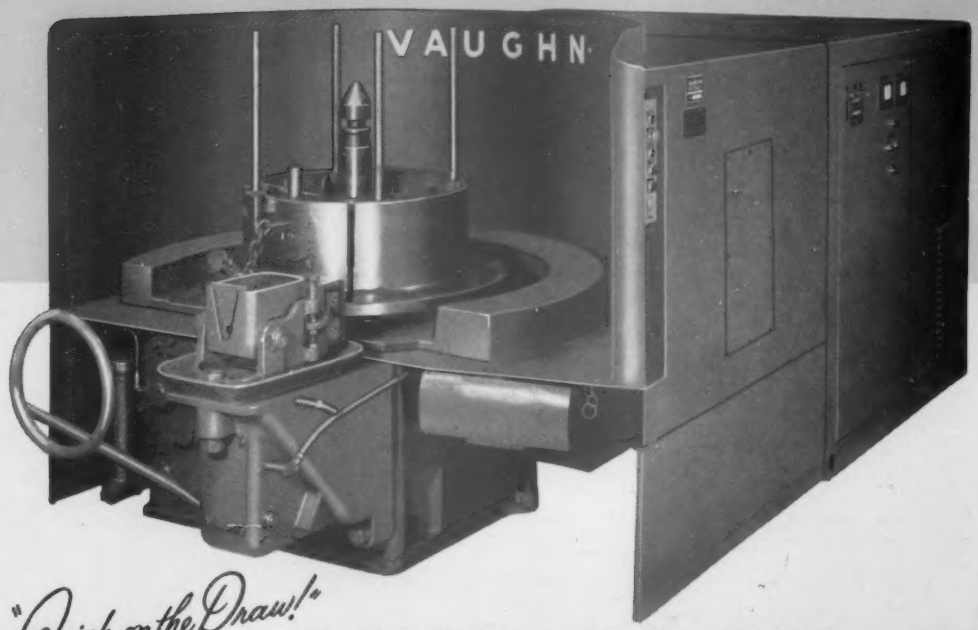
WIRE AND WIRE PRODUCTS

MARCH 1959

NOW... **PACKAGED PERFORMANCE**

in the **Motobloc®**



"Quick on the Draw!"

The standout advantages of Vaughn packaged design are now at your service in the husky MOTOBLOC—*self-contained,* electrically and mechanically. All electrical equipment, including motor generator set, starter and control circuit, is now contained in a single compact unit. Installation costs are lower, inspection and maintenance easier than ever before. You should have the facts on this modern Vaughn development—*write us.*

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO, U.S.A.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

Coulter & McKenzie DRAW-PAK *Equipment*

DRAW-PAK PAYS EXTRA DIVIDEND

The customer required a take-up for electro-tinned copper wire which would assure *trouble-free* payout to high speed drawing machines. Coulter & McKenzie immediately provided the solution with two Series "500" DRAW-PAK units arranged in banks of six capstans each.

These DRAW-PAK machines not only solved the original payout problem by eliminating frequent breaks and tangles, but they extended the length of the run and yielded *seven additional major improvements* in the product and operation. Look at the extra dividends which the DRAW-PAK paid:

1. **A full number draw is taken during take-up operation.**
2. **Tinning speed increased from 300 to 500 feet per minute.**
3. **Size of take-up package *doubled* — 250 lbs. to 500 lbs.**
4. **Higher degree of tension control assures more uniformity in the electro-tinning process.**
5. **Number of strands per plating tank increased from 4 to 6.**
6. **Fewer "lost" strands in tanks due to breaks.**
7. **25% to 30% increase in efficiency due to longer continuous runs.**

If you want to learn more about how the Coulter & McKenzie DRAW-PAK can help you, write to us today.

U. S. Patents 2,732,060, 2,868,474, 2,844,416, 2,868,263, and others pending.

Patents Pending

Your satisfaction is our greatest asset.

35 UNION AVENUE

THE COULTER & McKENZIE MACHINE CO., INC.

TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

SINCE 1942 BRIDGEPORT 7 CONNECTICUT U. S. A. INCORPORATED 1951

"America's Finest Wire Draw"

ANNOUNCES ANOTHER GREAT NEW LUBRICANT!!!

Number 937

No. 937 is a complex high-titre soap.

No. 937 does not require any special die practices.

No. 937 produces a tough, dense, uniform coating.

No. 937 is completely adaptable for Rods or Wire, either lime, Stancoat "L", or borax coated.

No. 937 is being used successfully for High and Low Carbon Wire drawing, including special finishes; e.g., spring wire of all types at finishing speeds above average.

No. 937 is a mill-tested and approved lubricant.

"Look to Standard for the Future"

Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

Cordially yours,

Standard Industrial

COMPOUNDS CO., INC.

Member WAS

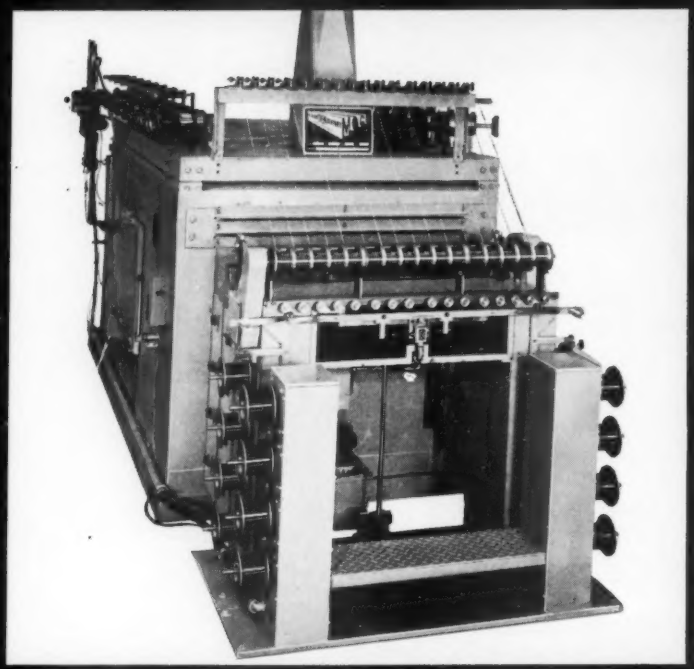
FRANKFORT, ILLINOIS

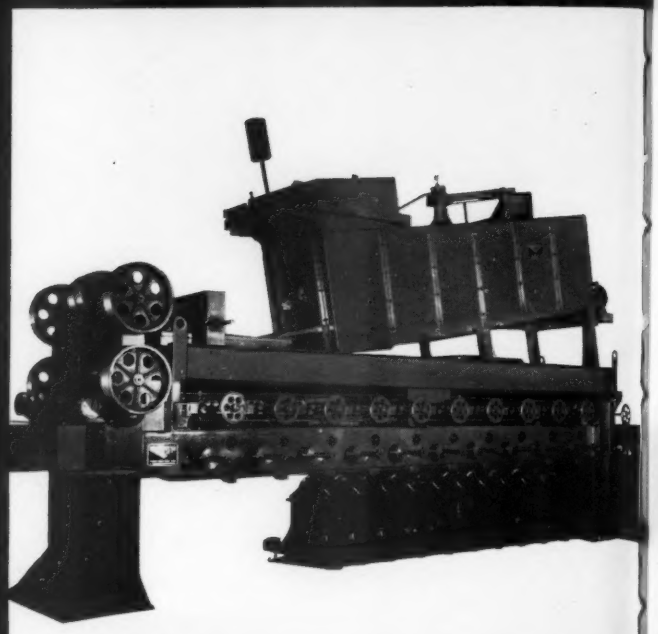
(A suburban Chicago area city)

Telephones: 2131 - 2141

EXPERIENCE:

Twelve years of development in gas-fired equipment— Three years of "on-the-job" production results





WIRE ENAMELING MACHINES

Typical of the complete line is this type "B" machine which handles wire from 31 A.W.G. to 42 A.W.G.

Five other models complete the range from the finest through large rectangles. The horizontal, high volumetric, recirculating double-pass oven allows greatly increased production by rapid heat impartation and a high degree of temperature uniformity throughout the wire chamber. Other features include: a catalyst within the recirculating stream consumes solvents and releases heat energy, individual clutches in each head of the wire capstan, automatic braking device controlling wire tension.

CONTINUOUS BRIGHT ANNEALERS

This is the first direct gas-fired annealer using the heating equipment as an internal inert atmosphere generator. Advanced mixing and burning equipments are utilized which exclude the need for external sources of steam or costly inert atmospheres. They are available in horizontal or vertical mounting positions. MOCO Annealers are of the high volumetric recirculating type with automatic air-fuel gas ration maintained over the entire range. They have a water sealed exit. No external source of inert atmosphere is needed.

WIRE ENAMELING DIVISION

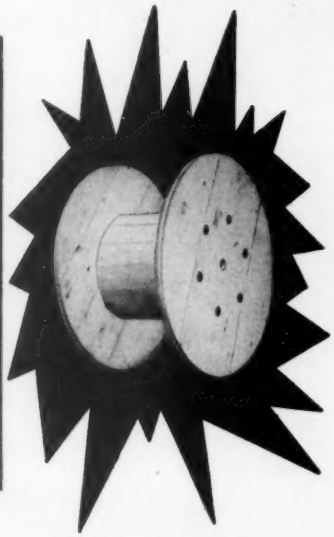
MICHIGAN OVEN COMPANY

425 Brainard • Detroit 1, Michigan

YES

NON-RETURNABLE

WOOD REELS IN ALL SIZES
FOR ALL TYPES OF ELECTRIC
WIRE AND CABLE . . . . . .



YOU SAVE WITH NON-RETURNABLES

- Reduced Reel Investment
- Less Storage Space
- Lower Freight Costs
- No Repair Costs
- No Return Freight Charges
- No Bookkeeping
- No Deposits Needed
- No More Headaches!!

HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST

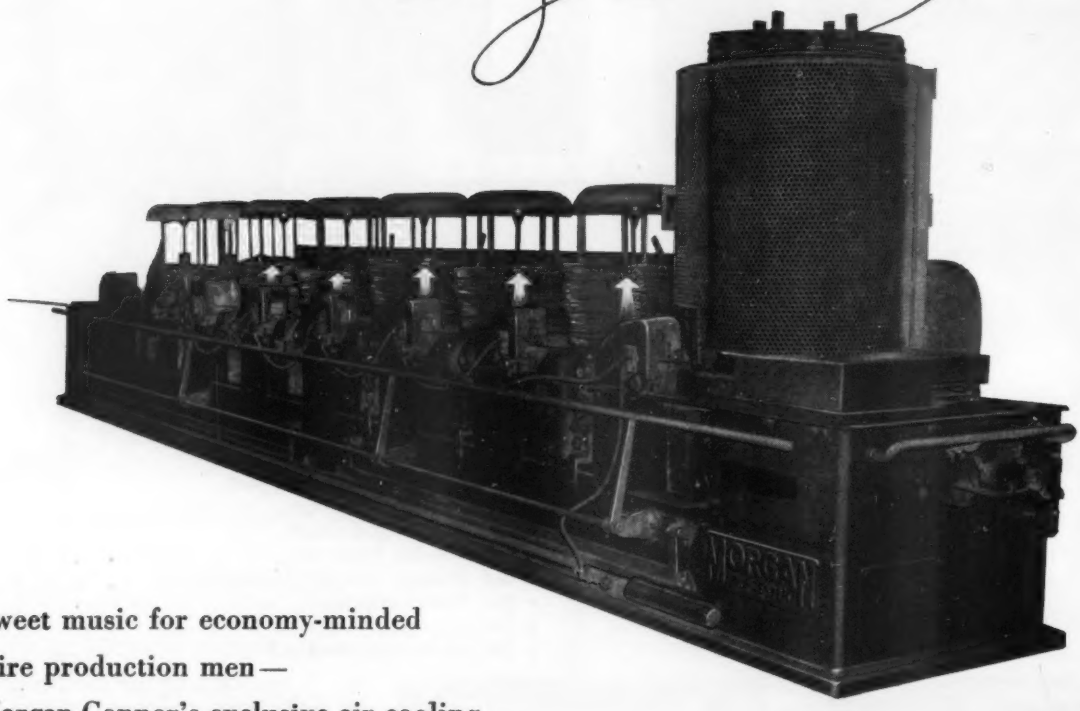
"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

draw it *FAST*

draw it COOL



Sweet music for economy-minded
wire production men—
Morgan-Connor's exclusive air cooling
gives you fast drawing
and high production.
You get superior results
at low die costs
and low power costs.

MORGAN
WORCESTER

WM-104

MORGAN CONSTRUCTION COMPANY — WORCESTER, MASSACHUSETTS

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 34 March, 1959 No. 3

Designated as Official Publication By The Wire Association

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HOW DO • •
COST CONSCIOUS
MANUFACTURERS
• • CUT COSTS?
CAREW, of course

CAREW NIPPERS
not only cut WIRE
but
CAREW CUTS COSTS!

They do not have a thousand uses. They are made only for cutting wire.

CAREW NIPPERS will continue to do this year after year; cutting efficiently long after most tools have been junked.

MADE IN 4 SIZES
8", 10", 12", 14"

This well-balanced tool is designed for constant use—gives longer service . . . . in effect

CAREW CUTS COSTS!
made since 1870 in
ROCKFALL, CONNECTICUT
by
M.W. ROBINSON CO., Inc.
and stocked by most mill supply jobbers.

for exacting wire and cable insulation specify "job-engineered"

BLACAR®

PVC RESINS & COMPOUNDS

PVC RESIN—Blacar #250—UL-approved for complete interchangeability in recognized compounds. High Molecular weight—low gel count—excellent dry blending and extrusion characteristics. Intermediate and low molecular weight resins also available.

PVC COMPOUNDS—In natural, white or black—dry blend or diced.

Blacar #2800—UL-approved for type T and TW wire—oil at 60°C — 80°C appliance wire.

Blacar #2700—UL-approved, primary insulation, for type T, TW, TF, TFF wire—oil at 60°C—wide range of low-tension applications.

Blacar #2600—UL-approved for type TF, and TFF wire and cable insulation.

Specialists in wire covering—Cary can modify existing formulation or custom-formulate to the most exacting requirements.

Technical assistance, data, or working samples on request.

FOR THE BEST IN PVC RESINS AND COMPOUNDS—LOOK TO CARY!

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Mail Address: PO BOX 1128, NEW BRUNSWICK, N. J.
Plants At: EAST BRUNSWICK & FLEMINGTON, N. J.

VINYL RESINS • VINYL COPOLYMERS • VINYL COMPOUNDS • SPECIALTY WAXES • HIGH MELTING POINT SYNTHETIC WAXES

Canadian Representative: Lewis Specialties, Ltd., 18 Westminster North, Montreal 28, Que.

Here is COOK's combination fine

WIRE DRAWING and ANNEALING UNIT

. . . most compact, most complete machine of its kind ever designed!

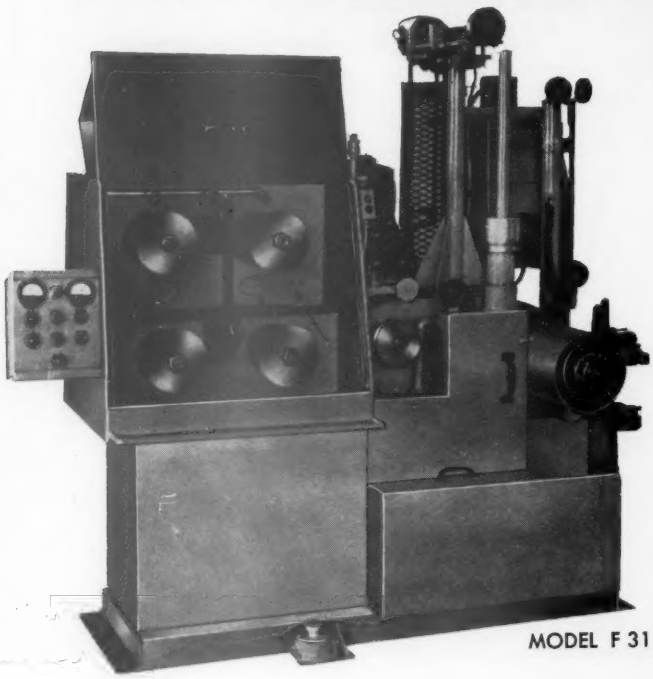
FLOOR SPACE only 6.5' x 3'

Heavy steel plate, all-welded construction • One central control panel • Over-driven spooler prevents slip and wear on finishing capstan • No scuffing or splintering of finished wire • Maintains uniform wire speed throughout entire spooler build-up • Wire tension can be regulated while machine is in operation • Die arrangement permits full horizontal string-up • Provides continuous run of clean, uniformly annealed wire in a complete range of sizes • Prevents wire discoloration • Eliminates double handling of wire and spools • Saves time because annealed wire is available when drawn • Runs efficiently at high speed • No power waste; no warped spools • Spare parts and machine service always available • Will give many years of trouble-free (24 hour-a-day) service at low operating and maintenance cost • This easy-to-operate machine is supplied complete with main drive motor and fully wired controls

ANNEALER ALSO AVAILABLE AS A SEPARATE UNIT ADAPTABLE TO OTHER MAKES OF DRAWING MACHINES

Annealer drive and control, including transformer, are an integral part of Model F31A . . . illustrated

You will recognize this as a greatly improved version of the famous, original COOK DRAWER-AND-ANNEALER



MODEL F 31 A

MACHINE SPECIFICATIONS

Maximum wire entering size . . . #14 B&S gauge • Finished wire size . . . #26 to 34 B&S gauge • Operating speed . . . 4,500 ft. per minute • Maximum number of dies . . . 16 • Number of drawing shafts . . . 4 • Size of die case . . . 1" x ½" thick • Motor size . . . 15 HP • Spool capacity . . . 40 to 90 lbs. • Spool flange diameter . . . 8" to 12" • Spool traverse . . . 6" to 8"

ANNEALER SPECIFICATIONS

Wire range . . . #26 to 34 B&S gauge • Electrical supply . . . 7.5 K.V.A. single phase • Power consumption relative to wire size

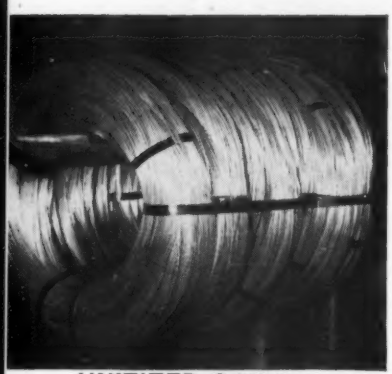
Call or write to COOK Manufacturing Co.

50 E. 25th ST., PATERSON 4, N. J., ARmory 4-6380

Wire and cable processing and fabricating machines

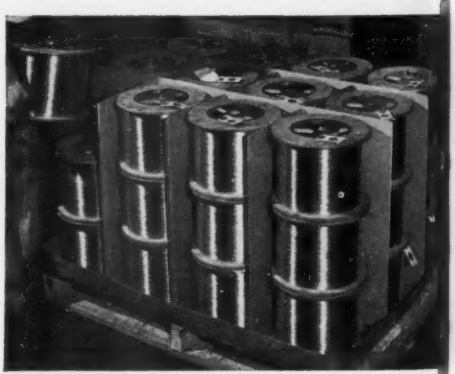
Canadian agent: E. V. Larson Co., Ltd., Toronto ★ In Europe: Capamadjian Le Monnier Cie Ltd., Paris, France

Other new AS&W Wire Packages mean important savings in



UNITIZED COILS:
Several regular mill coils bound in one unit to speed up handling and save storage space. Unitized coils carry no price extra!

PAY-OFF DRUMS:
Large, fibre, disposable carton containing long continuous wire coil. Pay-Off Drum is easy to handle and stack, protects wire finish from dirt and corrosive atmospheres.



DISPOSABLE SPOOLS:
Contain up to 65 pounds of fine wire; are shipped on expendable pallets. These non-returnable spools are convenient to handle and stack.

WEIGHT WIRE COILS

save you down time...

handling time...storage space

...at no increase in cost!

If your mill machines are set up to run with these continuous-wire, heavy-duty coils, they will pay off for you in three ways:

They will speed up your production by eliminating unnecessary down time, unnecessary idling of operators and machines.

They will save handling time. One large coil can be handled in a fraction of the time needed to move the same weight in smaller coils.

They save storage space. This big coil takes up far less space than the same weight in smaller coils.

And you get all these advantages as standard mill practice. *USS and American are registered trademarks*

USS American Manufacturers Wire

---

time and storage!

PLATFORM COIL CARRIER: This non-returnable unit is made of U-shaped wire frame attached to deck platform, holds up to 3,000 pounds of wire in continuous lengths.

All of these new American Steel & Wire Packages are planned to serve you better, to help you use warehouse space to better advantage, to save time and money.

For more information, get in touch with the nearest district office of American Steel & Wire. General Offices: American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

American Steel & Wire Division of United States Steel

USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
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COAST-TO-COAST SATISFACTION!

...AMCHEM GRANODRAW SS

specified by leading metalworking manufacturers to improve drawing and cold forming of stainless!

In the Amchem Granodraw SS process a thin, uniform oxalate coating is deposited on stainless prior to lubrication and working. This coating is instrumental in preventing metal to metal contact between work and tool, prevents galling and seizing, acts as a carrier for the lubricant to reduce friction.

Wherever it is used, Amchem Granodraw SS has proved its merits over competing products—in a finer, denser, more continuous coating of greater penetrating power to coat contact areas. The result is a trouble-free, service-free product with basic user advantages of greater speed of draw, greater total reductions, longer tool life, easier inspection, finer finishes and more effective lubrication!

If you work in stainless, you'll work faster, better and more economically with Amchem Granodraw SS!

NEW AMCHEM SERSEAL* AVAILABLE OVER GRANODRAW SS BATHS!

Newly developed Amchem Serseal provides an effective chemical blanket over coating baths to prevent escape of heat and fumes. In actual field use, *heat savings of up to 70% have been reported,* with substantial reductions in cost and time required for maintenance of heating elements and elimination of costly ventilating systems! Call your Amchem man or write for full details.

*Patent Applied for

Complete details about Amchem Granodraw processes are contained in Bulletin 1437. Write for your copy today.

AMCHEM **GRANODRAW SS**

GRANODRAW SS is another chemical development of **Amchem Products, Inc.** (Formerly American Chemical Paint Co.) Detroit, Mich. • St. Joseph, Mo. • AMBLER 31, PA. • Niles, Calif. • Windsor, Ont./Amchem and Granodraw SS are registered trademarks of Amchem Products, Inc.

Improved

SHAFTLESS TAKE-UP

General Specifications

Both side frames move in or out simultaneously, keeping center of reel traverse always in line with delivery point of cable, thus equalizing and minimizing cable deflection.

Reel gear and drive pinion remain in engagement at all times.

Quick traverse reversing by air valve.

Motor driven screw width adjustment.

Motor driven screw reel lift.

Traverse adjustable for reel width and cable diameter, while machine is running.

Traverse speed adjustable over range of cable diameters in increments of 1/20.

Drive can be supplied to suit customer's requirements.

Mechanical slip clutch friction drive for the capstan.

Variable speed motor drive with manual control.

Variable speed motor drive with automatic electrical control.

Available in the following sizes:

36" dia. reel to 52" dia. max.
36" dia. reel to 72" dia. max.
36" dia. reel to 84" dia. max.
42" dia. reel to 96" dia. max.

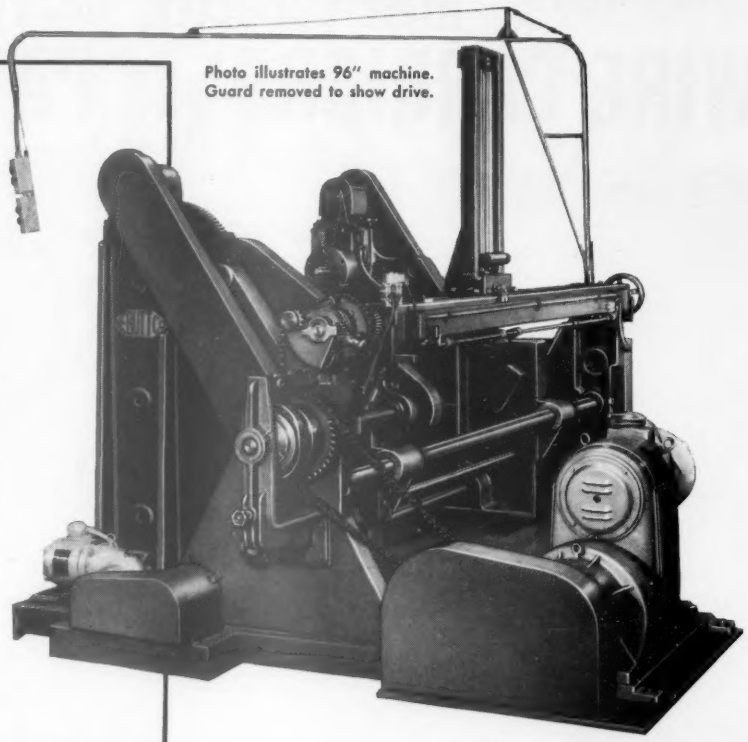
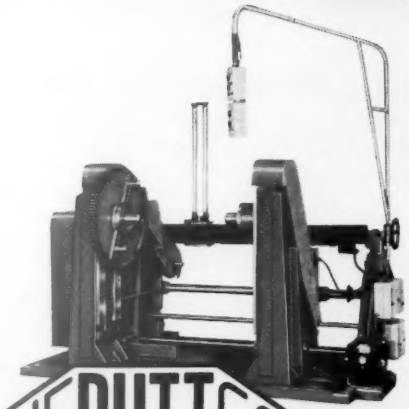


Photo illustrates 96" machine. Guard removed to show drive.

This heavy duty Take-Up includes latest developments which further increase ability to produce high quality cables. Many of these machines, in the previous model, are in continuous, trouble-free operation in plants throughout the country. It handles bare or insulated cables of all weights and sizes at a wide range of speeds . . . is readily controlled by the operator by means of the convenient swinging pendant push button station. Various drives can be provided and the machine readily adapted by our engineers to meet your special requirements. Write us for further information and details.



NEBUTTCO

Braiders
Cablers
Take-ups
Bunchers
Stranders
Taping Machines

NEW ENGLAND BUTT CO.

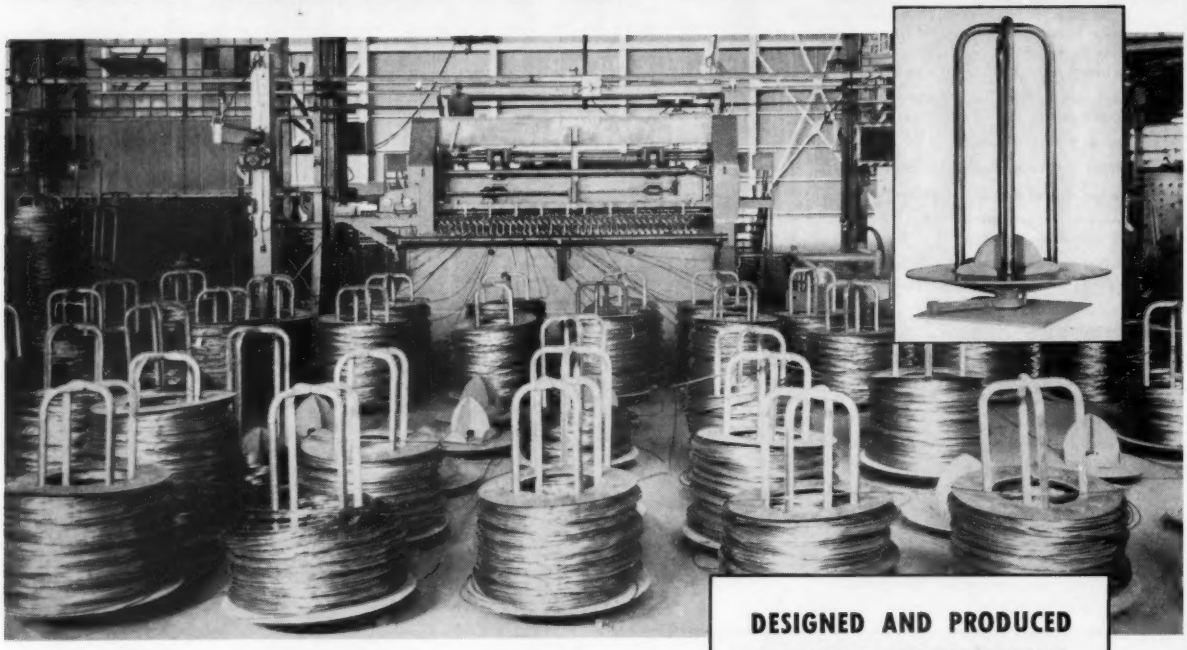
DIVISION WANSKUCK COMPANY

304 Pearl Street · Providence 7, R. I.

In England — James Day (Machinery) Ltd., 28 Maddox Street, London, W-1.

WORKING WONDERS WITH WIRE: UP goes production efficiency, DOWN go losses at Detroit Steel Corporation

...thanks to Northern Indiana Steel's high capacity, heavy-duty WIRE CARRIERS and PAY-OFF REELS



WIRE DRAWING—DETROIT STEEL STYLE

Behind-the-scenes at the recently-installed welded wire fabric machine, which draws wire for the widely-known LPR Coils at Detroit Steel Corporation's Portsmouth, Ohio Plant. You see the entry side of the giant machine, with Northern Indiana Steel Wire Carriers and Pay-Off Reels in use for both feeding and storaging wire to the unit. In this way interruption is reduced to a minimum.

"MAKES LONG PRODUCTION RUNS POSSIBLE,"

says Detroit Steel's Rod and Wire Division head:

Reports Superintendent U. V. Johnson, "The introduction of these wire carriers and pay-off reels as part of our handling equipment has greatly improved the efficiency of our wire drawing and welded fabric operations. It makes long production runs possible in wire-making and wire-users plants."

DESIGNED AND PRODUCED TO YOUR SPECIFICATIONS

Wire Carriers and Reels that

- ✓ FEED MORE SMOOTHLY
- ✓ CARRY UP TO 4,000 LBS.
- ✓ STACK AND STORE EASILY

Let us know exactly what your operating needs require. If we don't already have it in stock, we're ready to make up your order as per your specifications. In any case, we'll be pleased to quote you promptly in quantities specified.

Northern Indiana Steel Supply Co., Inc.

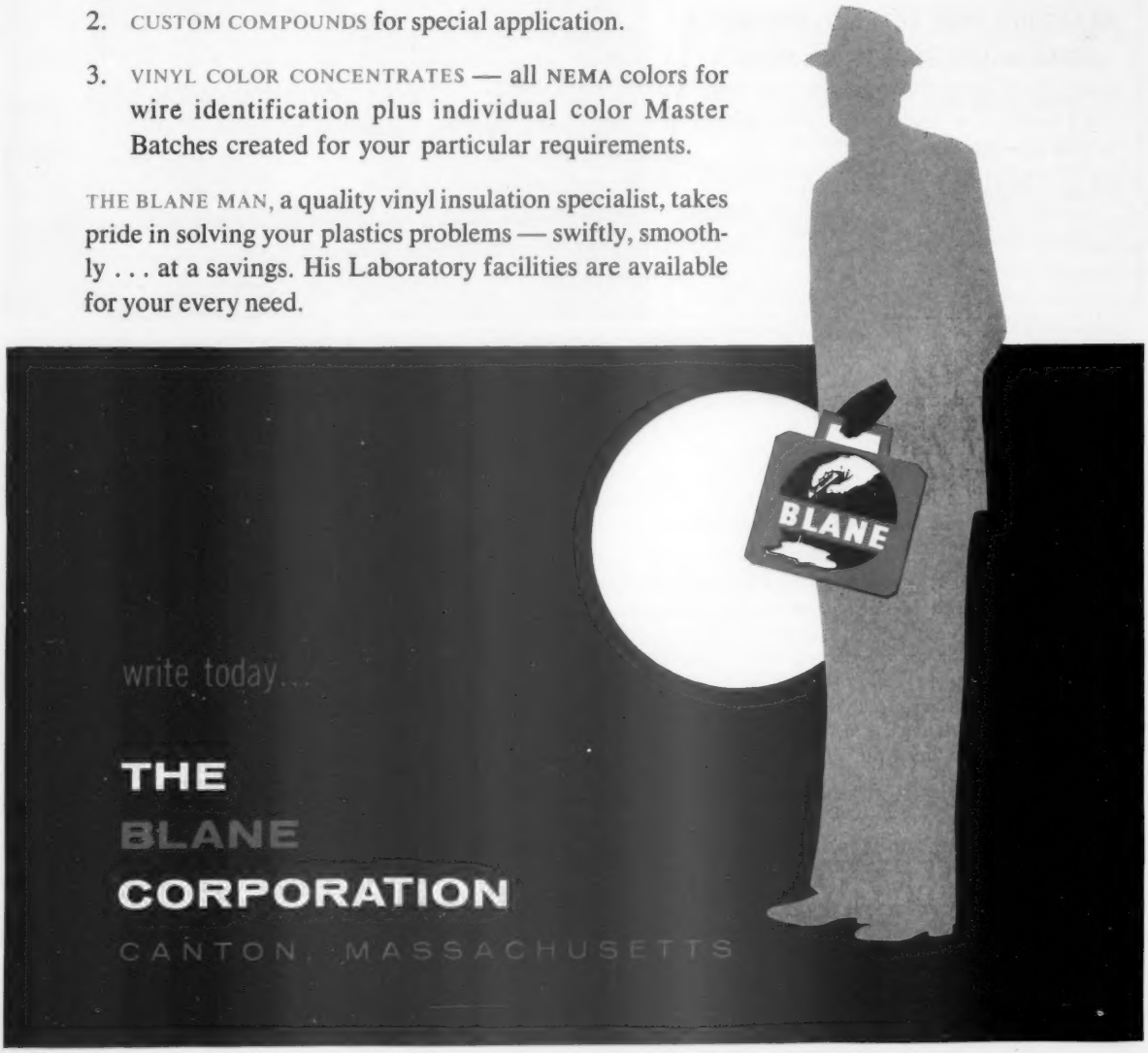
Fabricating Division, Michigan City, Indiana

TELEPHONE TRiangle 4-3241

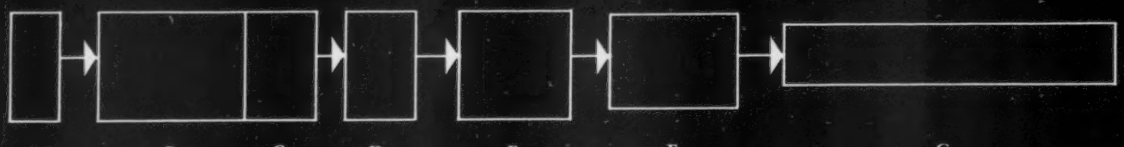
wire and cable industry... **THE BLANE MAN SERVES YOU!**

1. COMPOUNDING a complete line of vinyl molding and extrusion compounds.
2. CUSTOM COMPOUNDS for special application.
3. VINYL COLOR CONCENTRATES — all NEMA colors for wire identification plus individual color Master Batches created for your particular requirements.

THE BLANE MAN, a quality vinyl insulation specialist, takes pride in solving your plastics problems — swiftly, smoothly . . . at a savings. His Laboratory facilities are available for your every need.

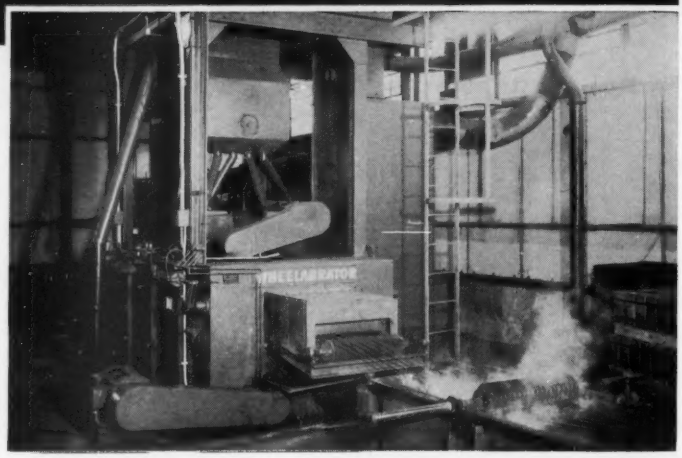


FROM HOT ROLLED ROD THROUGH PATENTING, CLEANING AND COATING IN ONE CONTINUOUS OPERATION



THE LESCHEN WIRE ROPE DIV. AUTOMATED STRAIGHT-LINE PRODUCTION METHOD

A. Twelve-strand Payoff Reels.
B. Rod Annealing Furnace.
C. Lead Quench (Patenting).
D. Water Quench.
E. Wheelabrator Abrasive Blast Descaling Cabinet.
F. Borax Coating and Drying.
G. Horizontal Takeup Recoilers.



Leading producers of wire products are now using Wheelabrator® straight-line abrasive blast descaling as the shortest distance between steel rod and wire profits. At H. K. Porter Company, Inc., Leschen Wire Rope Division, St Louis, for example, this process is resulting in exceptional production efficiency and economy.

The automated processing line starts with hot rolled rod, and in one continuous operation produces cleaned and coated rod for subsequent drawing. Wheelabrator mechanical blast descaling is an essential step in this process. It cleans twelve strands at a time in line with patenting, coating and drying and delivers cleaned and coated rod for multiple hole drawing. There is no interruption and no intermediate handling required. Furthermore, the line operates continuously five days a week, 24 hours a day without downtime.

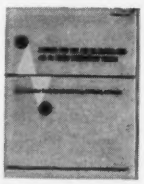
All scale or rust is completely removed down to virgin metal, at speeds required for patenting. The fine matte finish obtained holds a more uniform coating and provides excellent drawing characteristics. This blast descaling process offers freedom from the problems associated with acid pickling. And, through automated production, important additional savings in time and labor costs are achieved by reducing "in process" inventories.

It will pay you to consider this new process for cleaning any type of ferrous or non-ferrous hot rolled rod and bar stock for cold drawn products.

WHEELABRATOR
CORPORATION
389 South Byrkit Street Mishawaka, Indiana
Canadian Offices: Scarborough (Toronto) – Montreal

HOW TO AUTOMATE YOUR WIRE DRAWING LINE

This new booklet explains how Wheelabrator blast descaling can enable automation of your wire production. Write for Bulletin 148-D.



WORLD'S LARGEST MANUFACTURERS OF AIRLESS BLAST CLEANING EQUIPMENT AND STEEL ABRASIVES

VYGEN® special PVC compounds and resin

FOR WIRE AND CABLE COATING

In addition to Vygen 120 PVC resin, there are *three* specially-formulated Vygen compounds completely tested and UL-approved for specific wire and cable applications. Available in quantities to fit your needs, each Vygen compound and resin is composed of the very finest raw materials, processed in the most modern facilities. Each is designed to do its job better, *and* to save you money. Send for generous samples, literature and technical assistance.

VYGEN 6812 COMPOUND

UL-approved for UF-NMC cable, Type T, TW, 60°C, Oil, and 80°C appliance wire applications. May also be used as primary insulation for other cable constructions and jacketing.

VYGEN 6035 COMPOUND

UL-approved for Type T, TW, and exposure to oil use at 60°C. This compound combines excellent physical and electrical properties with very good weather and flame resistance.

VYGEN 9221 COMPOUND

Meets UL requirements for 90 and 105°C applications. Recommended for appliance, radio hook-up, machinery wire etc. where heat resistance and good physical properties are required.

VYGEN 120 RESIN

UL-approved as interchangeable with other PVC resins used as wire insulating material. For fast dry-blend extruding with monomeric or polymeric plasticizers—assures lack of gelled particles, excellent heat and light stability and long life.

TYPICAL ANALYSIS

Form	White Powder
Intrinsic Viscosity	1.18
Specific Gravity	1.40
Bulk Density, gm/cc	0.52
lbs/ft³	32.5
Volatiles	0.2

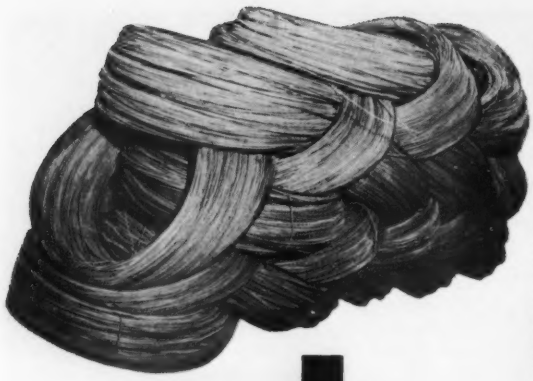
Creating Progress Through Chemistry

PHYSICAL PROPERTIES OF MOLDED SPECIMENS

	6812	6035	9221
Specific Gravity at 25°C/4°C	1.32	1.33	1.38
Tensile, psi at 25°C	2550	2950	3100
Modulus at 100% Elongation, psi	1450	1780	2150
Elongation, % at 25°C	320	315	340
Hardness, Shore A, inst at 25°C 10 sec at 25°C	90 82	94 86	97 92
Brittle Point, at – 15°C	Passes	Passes	Passes
Volume Resistivity, ohm-cm at 25°C and 50% R. H.	3.1×10^{14}	2.8×10^{14}	3.5×10^{13}

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO.

VYGEN ®



The RIGHT COMBINATION for LOWEST COST Straightened and Cut Wire!

Savings with a SHUSTER

Above is the ALL NEW SHUSTER 2AV infinite variable speed, automatic Wire Straightening and Cutting Machine

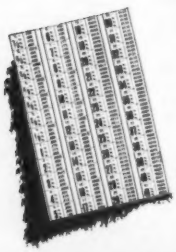
wire size range:
1/16" to 5/16" mild steel wire, 1/16" to 3/16" high tensile wire, 50 to 200 FPM.
Send for complete details today!

MATERIAL: Wire in coils purchased at lowest price.

STORAGE: Less floor space required than for storage of straightened and cut lengths.

DELIVERY: *When* you *need* it. Eliminates damaged wire waste.

COST: SHUSTER is the oldest (1866), most dependable name in wire straightening and cutting. Always ahead with the best, *tested* machine refinements, SHUSTERS cost *less* than any comparable machine.



Send us your wire straightening requirements from .020" to 1 1/16" for quotation. Let us show you that a SHUSTER pays its way faster than any comparable machine!

Get the facts from one of our more than sixty representatives throughout the United States and Canada. There is one near you!

Send for free, wall size split gauge wire chart from 41 gauge to 7/0.

METTLER MACHINE TOOL, INC.

155 W. Adeline, New Haven, Connecticut

Are You Getting What You Pay For?

When you pay for HIGH QUALITY high-carbon wire, you want to be sure you get it. You do, when it is supplied by Roebling.

It is unsurpassed in quality, consistently true to specifications, and absolutely uniform in gauge. Hundreds of manufacturers attest to this fact . . . the qualities that they *pay* for—they *get* in Roebling high-carbon wire. The length of our relationship with customers proves it.

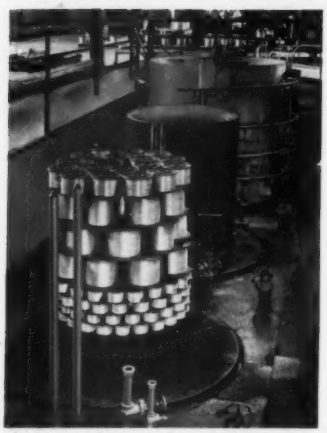
We'll be glad to show you what we mean. For information on superior high-carbon wire or cold rolled strip, write Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

This lightweight "No Charge" spool is typical of Roebling's modern packaging methods that save customers time and money.

ROEBLING

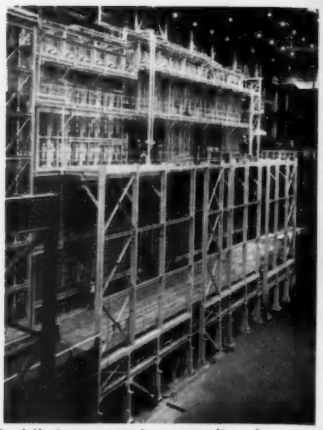
Branch Offices in Principal Cities—Subsidiary of The Colorado Fuel and Iron Corporation

Roebling... Your Product is Better for it

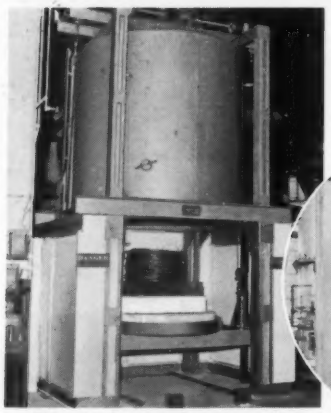


Bell type furnace for spooled wire.

Sunbeam WIRE and STRIP FURNACES

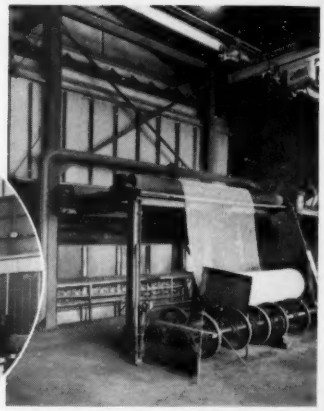


World's largest strip annealing furnace.

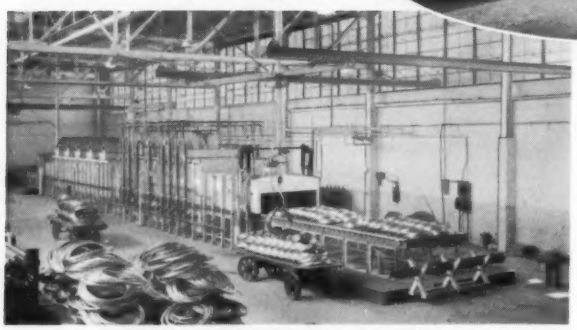


Elevator furnace for wire coils.

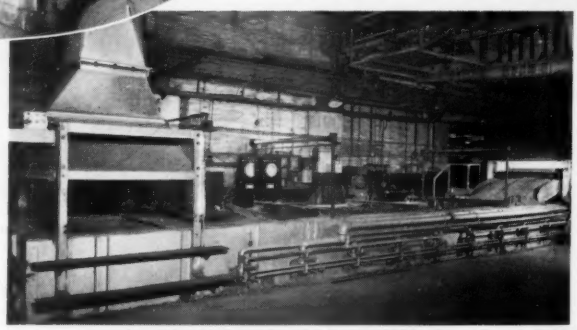
Bell type furnace for wire or strip.



Galvanizing furnace for fencing.



Roller hearth furnace for wire coils.



Lead bath furnace for wire in strands.

Complete service available . . . design through installation

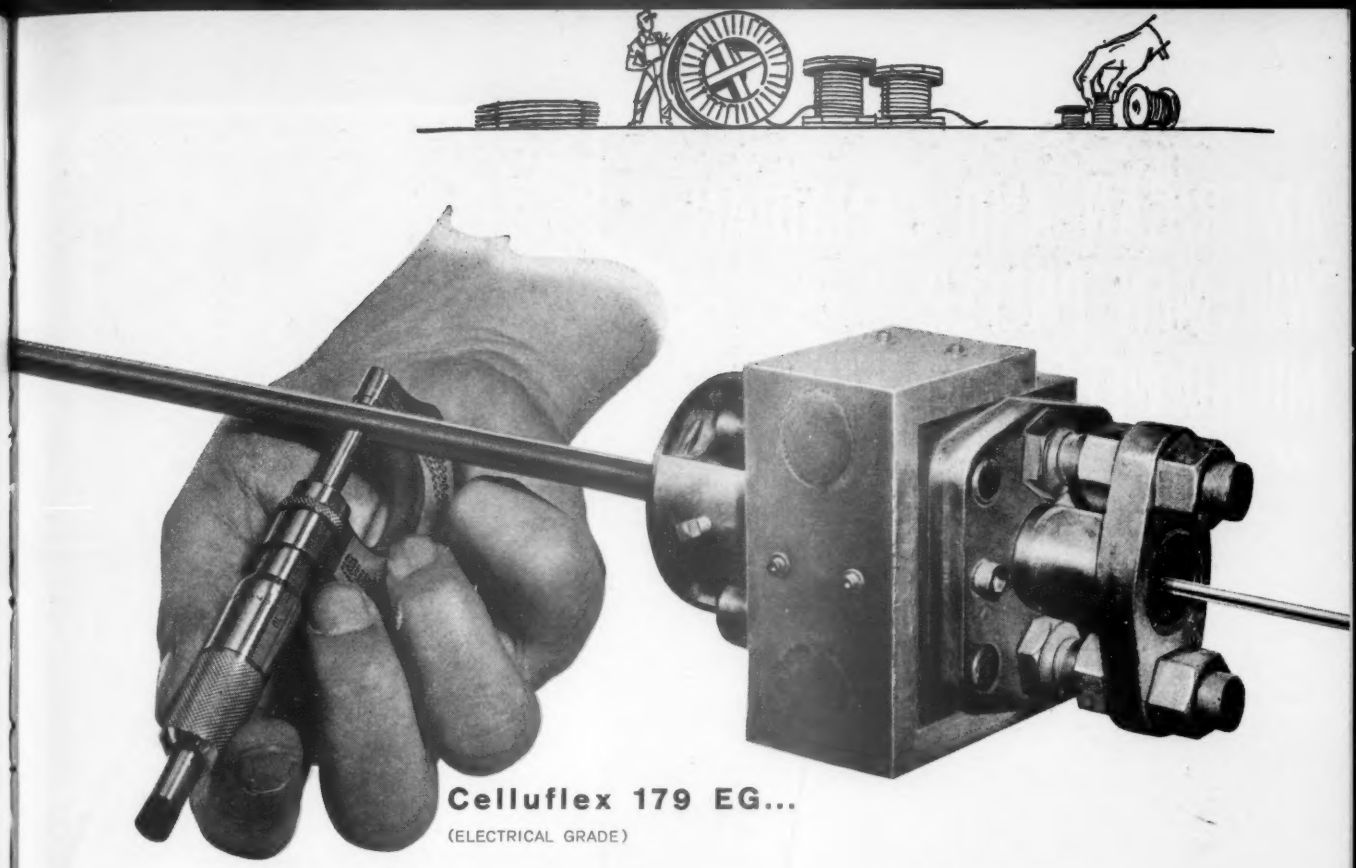
Sunbeam equipment for the metals industry includes complete wire and strip furnace installations . . . batch or continuous—for ferrous and non-ferrous metals. We build the largest, the smallest and everything in between. All auxiliary equipment for heat treatment including cleaning, cooling, fluxing, coating, atmosphere generation, process and control panel, and handling equipment can be furnished as a single contract. In this manner you obtain the many added advantages of dealing with a single supplier—in purchasing, planning, delivery, installation and service. Whether planning an expansion, opening a new plant or replacing equipment, it will pay you to see Sunbeam first. Let us know your requirements.

Sunbeam

THE BEST INDUSTRIAL FURNACES MADE

Sunbeam EQUIPMENT CORPORATION

Dept. 252 180 Mercer St. Meadville, Penna.



Celluflex 179 EG...

(ELECTRICAL GRADE)

selected for dependability and ease of processing

... add excellent volume resistivity, low volatility, fire resistance, excellent solvating action, oil and water resistance . . . result: a tricresyl phosphate specially developed for the wire and cable industry for application in vinyl coverings.

Celanese is an expanding source for plasticizers for many jobs. Shipments from convenient distribution points are ready to meet tight schedules.
Write Celanese Corporation of America, Dept. 590-C, Chemical Division, 180 Madison Avenue, New York 16, N. Y., for complete information.
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Celanese® Celluflex® Lindol®

Celluflex 179 EG . . . a Celanese CHEMICALS plasticizer

Call Celanese for: Tris-beta Chlorethyl Phosphate ... *CELLUFLEX CEF;* Epoxy Plasticizers ... *CELLUFLEX 21 and 23;* Four grades of flame-retardant Tricresyl Phosphate ... *LINDOL (low color)* ... *CELLUFLEX 179A (low specific gravity)* ... *CELLUFLEX 179C (general purpose grade)* ... *CELLUFLEX 179EG (electrical grade);* Cresyl Diphenyl Phosphate ... *CELLUFLEX 112;* Dibutyl Phthalate ... *CELLUFLEX DBP;* Dioctyl Phthalate ... *CELLUFLEX DOP;* Triphenyl Phosphate ... *CELLUFLEX TPP.*

AMERICAN AND CANADIAN WIREMEN PREFER MICRO-WELD BUTT WELDERS

BECAUSE . . .

They mean dependable equipment. They are built to meet specific welding requirements, and are adaptable either in the mill or laboratory.

Their ease of operation is appreciated both by the operators and management.

Perfect alignment of wire ends is assured on MICRO-WELD Butt Welders.

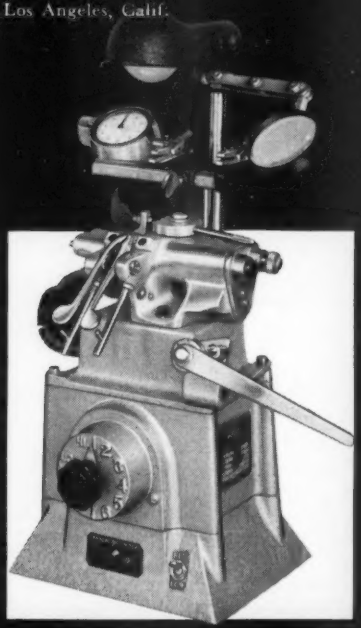
These are just a few of the users of the Model E-1-S MICRO-WELD Butt Welders in North America —

CANADA

Avro Aircraft, Toronto, Ont.
British Ropes Canadian Factory, Ltd., Vancouver, B.C.
Canada Wire & Cable Co., Leaside, Ont.
Donald Wire Rope Co., Hamilton, Ont.
B. Greening Wire Co., Hamilton, Ont.
Hamilton Wire Products Ltd., Hamilton, Ont.
National-Standard Co., Guelph, Ont.
Northern Electric Co. Ltd., Lachine, Que.
Steel Co. of Canada, Hamilton, Ont.
Wrights' Canadian Ropes, Ltd., Vancouver

U.S.A.

Columbia-Geneva Steel Co., Pittsburg, Calif.
Colorado Fuel & Iron Corp., Pueblo, Colo.
K. H. Davis Wire & Cable Corp., Los Angeles, Calif.
E. H. Edwards Co., San Francisco, Calif.
Pacific Wire Rope Co., Los Angeles, Calif.
Acme Steel & Wire Co., Chicago, Ill.
American Steel & Wire, New Haven, Conn.
Trenton, N.J.
Cleveland, Ohio
Waukegan, Ill.
Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Broderick & Bascom Co., St. Louis, Ill.
Seattle, Wash.
Peoria, Ill.
Houston, Texas
J. A. Roeblings' Sons, Trenton, N.J.



MODEL E-1-S MICRO-WELD BUTT WELDER. SUITABLE FOR BENCH MOUNTING

MICROMETER PRECISION — MICRO-WELD ®

MODEL E-1-S MICRO-WELD BUTT WELDER. MOUNTED ON 4-WHEEL TRUCK

Capacity .010" to .062" diameter high and low carbon steel wire, and alloy wire (thermocouple).

MICROMETER PRECISION — MICRO-WELD ®

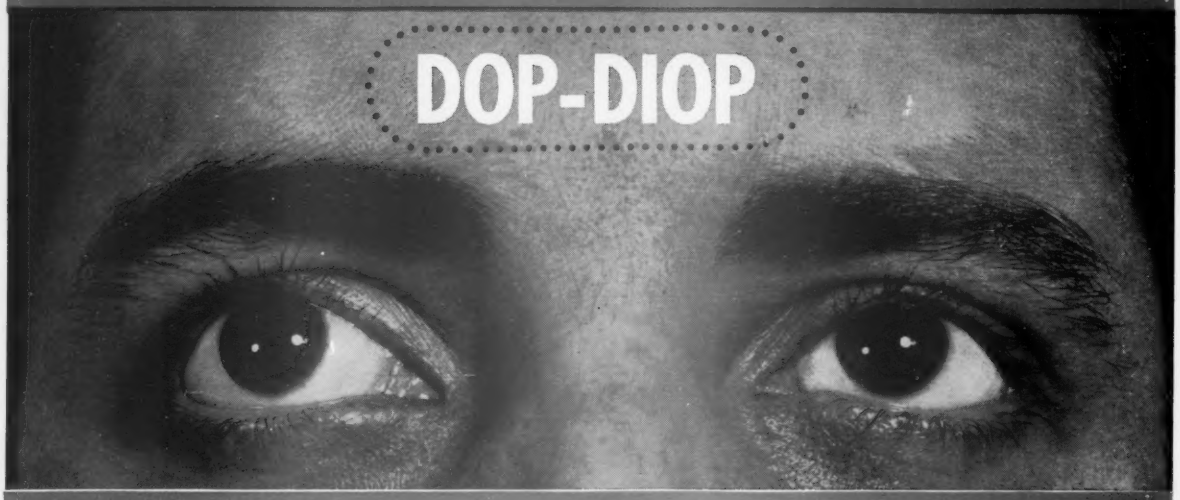
MICRO PRODUCTS CO.

20 NO. WACKER DRIVE • CHICAGO 6, ILLINOIS

TELEPHONE STate 2-7468

When you think of BASIC PHTHALATES . . .

DOP-DIOP



. . . think of BASIC PITTSBURGH!

IF YOU make vinyls, you know the importance of dependable supplies of DOP and DIOP. That's why so many vinyl producers list PITTSBURGH COKE as their primary supplier of these products.

PITTSBURGH takes pride in its ability to provide uniform, top-quality products . . . delivered on schedule . . . and backed by complete technical service.

Today, and ten years from today, our one aim will be to provide you with **better plasticizers at lower cost.**

WSW 7468

COAL CHEMICALS • PLASTICIZERS • PROTECTIVE COATINGS • ACTIVATED CARBON • CEMENT • COKE • FERROMANGANESE • PIG IRON

A deduction about INDUCTION

The machine above is a 3½ in. diameter screw size extruder. Other sizes available are 1½, 2½, 4½ and 6 in. sizes. Die heads are available for sheathing, tubing, lay-flat and sheeting. Send for our Bulletin 302 for specific details.

Mains frequency induction heating is generally acknowledged to be the best for thermoplastic compression moulding and injection moulding. It is perhaps less well recognised, however, in the thermoplastic extrusion field, but GENERAL ENGINEERING CO. (RADCLIFFE) LTD., who maintain their progressive outlook on equipment for the electric cable industry, have adopted this method of heating for their new design of extruders which are, of course, equally applicable for all other thermoplastic extrusion duties.

Induction heating has several advantages over other types of heating the most important being that there is faster, perfectly even and more responsive temperature control. This reduces the effects of temperature cycling. Also, by permitting an increase in the high temperature heat exchange area, gives a greater cooling capacity and thus allows higher screw speeds under exothermic conditions. Higher operating temperatures are possible than with resistance heating, a matter of coming importance with some of the new plastics.

Apart from the heating system GENERAL ENGINEERING CO., have installed other mechanical improvements in their new design extruder and your enquiries are now welcomed.

General Engineering Company (Radcliffe) Limited

Station Works, Bury Road, Radcliffe, Lancs., England

Telephone: Radcliffe 2291 (4 lines) Telegrams: "General", Radcliffe, Manchester

Represented in nearly every country in the world

New route for a pinch of powder

Metallurgical Products Department reports on Carboloy® cemented carbides... and a new distribution policy that makes possible faster delivery of dies

Carbides are metal powders. Cemented and formed into die shapes, Carboloy cemented carbides have become one of the principal cost cutters in the wire industry today.

Now, with the appointment of Authorized Carboloy Die Distributors, you can get off-the-shelf delivery of standard Carboloy dies in all major wire areas. Complete die stocks are carried by each distributor, and he'll give you fast die fabrication and refinishing service, too.

These distributors will help you choose from *nine* grades of Carboloy cemented carbide for your special die needs to give you lowest cost production. Next time you need dies, it will pay you to call an Authorized Carboloy Die Distributor (listed at right).

CARBOLOY
CEMENTED CARBIDES

GLEN CARBIDE
704 Second Avenue
Pittsburgh, Pennsylvania
Phone: Court 1-4880

ALLIED CARBIDE
88-06 Van Wyck Exp.
Jamaica 18, New York
Phone: Olympia 7-5022

BRONSON & BRATTON
5161 South Millard Ave.
Chicago 32, Illinois
Phone: Reliance 5-6200

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

ANNOUNCING the WYREPAK

FEATURES

1. TURNTABLES COMPLETELY ENCLOSED.
2. BALL JOINT MOUNTED GUIDE SHEAVES FOR ALL ANGULAR SETTINGS.
3. ELECTRO-MECHANICAL TENSION CONTROL FOR EACH HEAD.
4. PRECISION GROUND PRESSURE ROLLS.
5. PRIME RUBBER LAGGED CAPSTAN.
6. ASSEMBLED AND ALL ADJUSTMENTS MADE WITH ALLEN SCREWS.
7. ALUMINUM CAPSTANS, WITH HARD-ANODIZED, POLISHED RUNNING SURFACES.
8. INDIVIDUAL MAINTENANCE ON EACH SECTION.

The drum packaging Take-Up System illustrated, Model S5-TC-S, was designed especially for Magnet Wire.

Other models are made for all types of ferrous and non-ferrous wires.

Advanced engineering and precision construction have evolved in this machine new concepts of speed and efficiency in the packaging of wire. Capacity: Min. size — #32 ga.; max. size — #20 ga. wire.

YOU ARE INVITED TO SECURE COMPLETE DETAILS REGARDING THIS ADVANCED PROCESS FROM —

Advanced Wyrepak Co., Inc.

11 HARRISON COURT PHONE: EDison 4-4274 BRIDGEPORT, CONN.

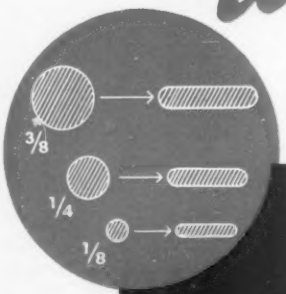
OR The Vaughn Machinery Co., CUYAHOGA FALLS, OHIO

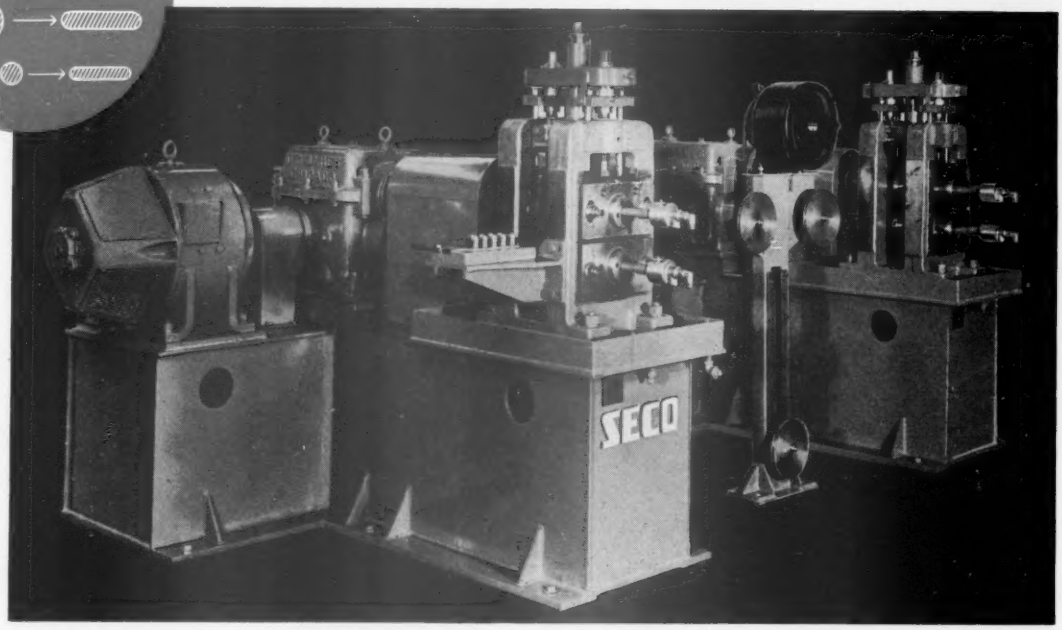
SECO

When You See SECO You're Seeing the Best!

Wire FLATTENING MILLS

Meet Today's High Standards of Quality and Efficient Operation





Shown above is the SECO 6" Tandem Mill with carboloy rolls and Timken Tapered Roller Bearings. Speed range is from 200 to 800 fpm. The mills are driven by DC motors through combination worm-helical reducers with universal joints, for silent and vibrationless operation. 8" and 10" mills of the same design and construction are also available. Suitable traverse reels are furnished.

Call or write for information and complete data. Consultation invited — no obligation.

STEEL EQUIPMENT COMPANY
P. O. BOX 737, WARRENSVILLE STATION
CLEVELAND 22, OHIO

SECO

6583

THIS IST

THE

THE IMAGE OF CF&I

...MAKER OF STEEL

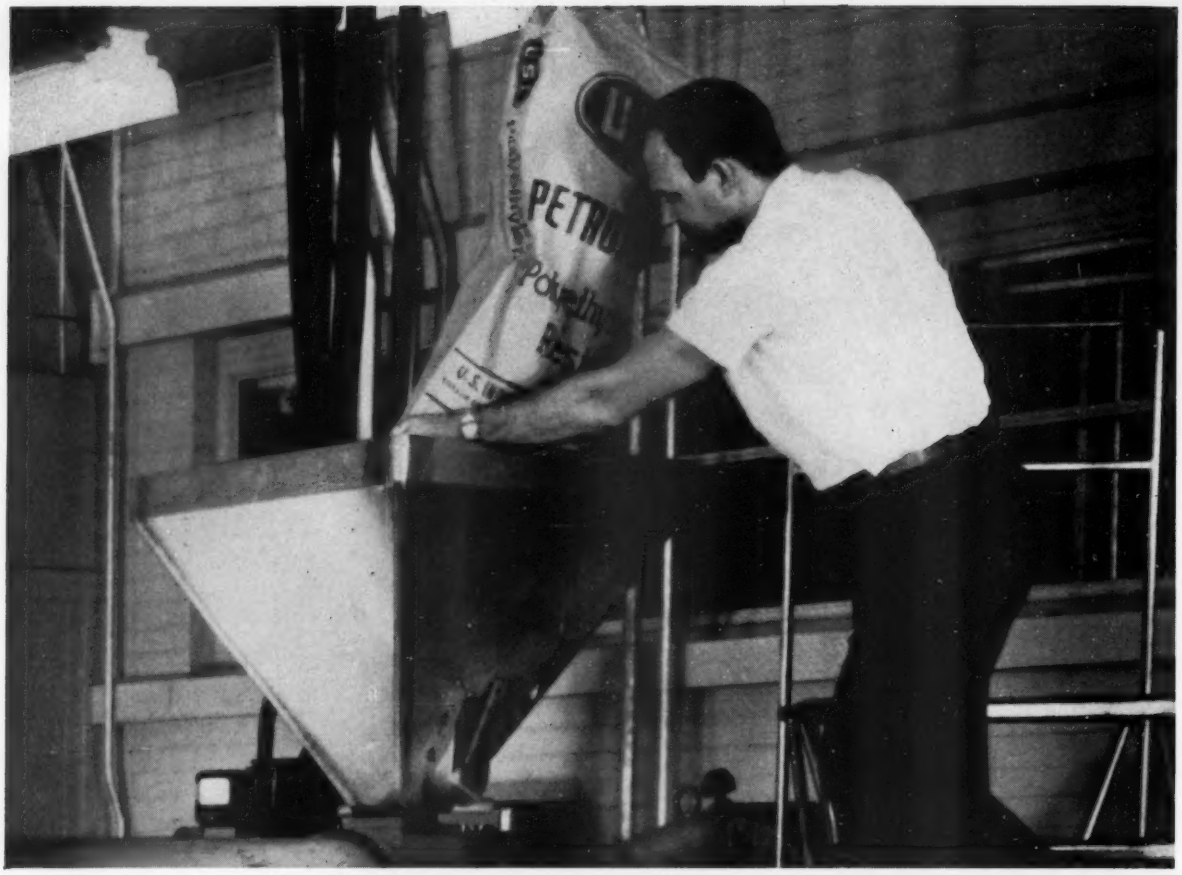
He's a giant steelman. He makes good steel and steel products for the diversified needs of today's economy. He anticipates tomorrow's requirements. He is constantly improving products through research and new manufacturing techniques.

His steel mills extend across the country. In them, he guards every step of manufacturing by rigid quality controls. And in his national network of offices and warehouses, he not only *sells* steel products, but he *serves* their users in every possible way.

He is the dynamic image of CF&I . . . the symbol of dependable steel products. Look for him when you buy.

Plants at:
Pueblo, Colorado • Oakland and South San Francisco, California
Buffalo, New York • Claymont, Delaware • Palmer, Massachusetts
Birdsboro, Pennsylvania • Roebling, New Jersey • Trenton, New Jersey
40 Warehouses and 60 Sales offices located coast to coast

THE COLORADO FUEL AND IRON CORPORATION
DENVER • OAKLAND • NEW YORK



You charge the resin as received when you produce polyethylene-covered wire

because polyethylene needs no blending

Manufacturing polyethylene-covered line wire is simple. You feed the resin, as you receive it, to the extruder. There are no plasticizers, softeners, antioxidants to add. There's no prebatching, blending, milling; no vulcanizing after extrusion. Carbon black and antioxidants are already in the resin.

A complete polyethylene production program simplifies operations in other ways too. One production line can take the place of several, providing savings in equipment, floor space, maintenance and labor. Stocking only one material reduces purchasing and inventory problems.

With polyethylene, you base production on a material that has trended downward in price as capacity increased. And ample capacity for PETROTHENE® polyethylene insures continuous supplies of uniformly high-quality resin.

Look To Tomorrow's Sales:
See how polyethylene can improve the profitability of your operations tomorrow, if not today. With other insulating costs trending upward, polyethylene can be expected to be your most profitable line wire coating in the years to come. You can prepare for those profits *by promoting polyethylene-covered line wire now*, just as U.S.I. is doing in a series of advertisements in utility magazines.

For your customers, polyethylene means a product that is easy to handle . . . has exceptional weather and stress-crack resistance . . . is long-lasting in service. This tough plastic covering is registering outstanding service records for power cable, communications cable, WD-1 infantry field wire, TV lead wire and many other applications.

U.S.I. PETROTHENE polyethylene resins are tailored to provide the proper balance of properties needed in different end uses. To help you choose the most suitable resin for each use, we've compiled a chart of the properties, applications and applicable specifications of PETROTHENE polyethylene compounds. This information is in a new four-page data sheet, "PETROTHENE Resins for the Wire and Cable Industry." Also available is U.S.I.'s comprehensive 100-page "PETROTHENE Polyethylene . . . A Processing Guide." Write for your copies.

U. S. Industrial Chemicals Co.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.

Please send me:
☐ "PETROTHENE Resins for the Wire and Cable Industry"
☐ "PETROTHENE Polyethylene . . . a Processing Guide"

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U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
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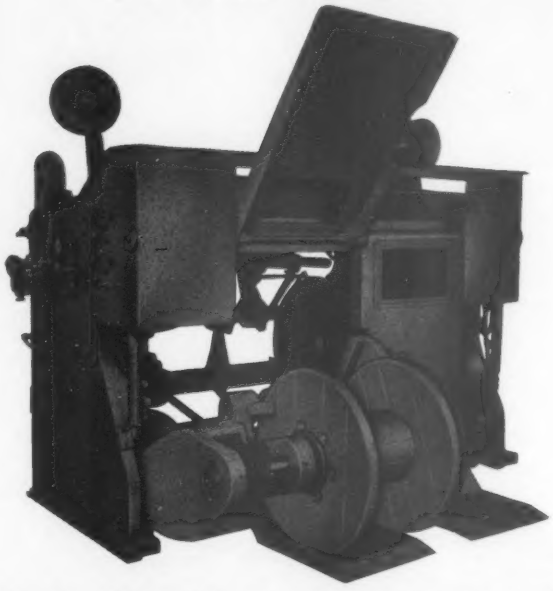
NEW HIGH-SPEED DUAL REEL TAKE-UP



Model DR-24HS Continuous Reeling of Insulated Wire at up to

4000 FPM

The new Davis-Standard high-speed Dual Reel Take-Up is designed to handle the lighter gauge wires at up to 4000 feet per minute with positive, clean cut-over at full wire speed.

DUAL MOTOR DRIVE — The empty reel is running at exact wire speed during cut-over. Only a dual motor drive permits the empty reel to spin faster than the full reel so that drum speed matches full reel build-up.

PATENTED RETRACTABLE WIRE GUIDE — Completes lay on full reel while main wire guide traverses at normal speed to empty reel starting position.

FRICTION DISC REEL DRIVES — Engage reels in any position, eliminate line-up of dog pin holes. Double pintles clamp both sides of each reel for smooth, high speed revolution without end play.

COMPLETELY AUTOMATIC GUARDING — Cannot be opened until full reel has stopped. Closes before reel drive starts.

For complete details on the new high-speed Dual Reel Take-Up Model DR-24HS for 12 to 24 inch diameter reels

Write to: . . .

D-S MYSTIC CONNECTICUT U.S.A.

DAVIS-STANDARD

DIVISION OF FRANKLIN RESEARCH CORPORATION

12 WATER STREET, MYSTIC, CONNECTICUT

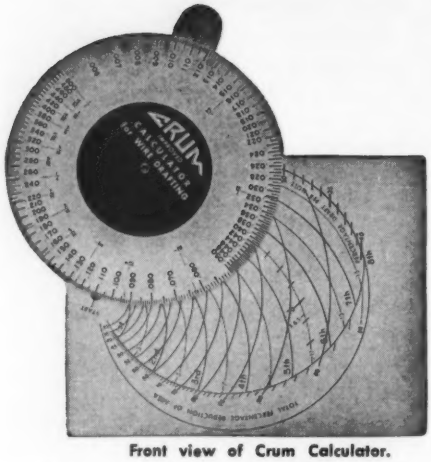
In Canada contact E. V. Larson Co. Ltd., 572 Queen Street East, Toronto 2, Ontario
in Europe and the Sterling Area contact Fawcett, Preston & Co. Ltd., Bromborough, England

AVE SET-UP TIME WITH THE . . .

CRUM CALCULATOR

FOR WIRE DRAFTING

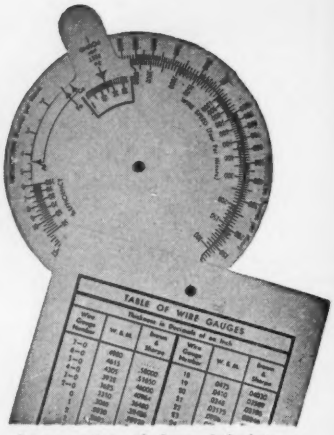
Useful and Accurate!



Front view of Crum Calculator.

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. Provide quicker and more accurate information on die sizes and reduction areas;
2. Calculate wire production rates for various speeds and efficiencies.



Reverse view of Crum Calculator.

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The improved Crum Calculator is worth its weight in gold in time saving —no laborious mathematical calculations necessary when you use it. Instruction sheet with examples accompany each Calculator. You should have one or more in your wire drawing department.

THE PRICE: $5.00 EACH

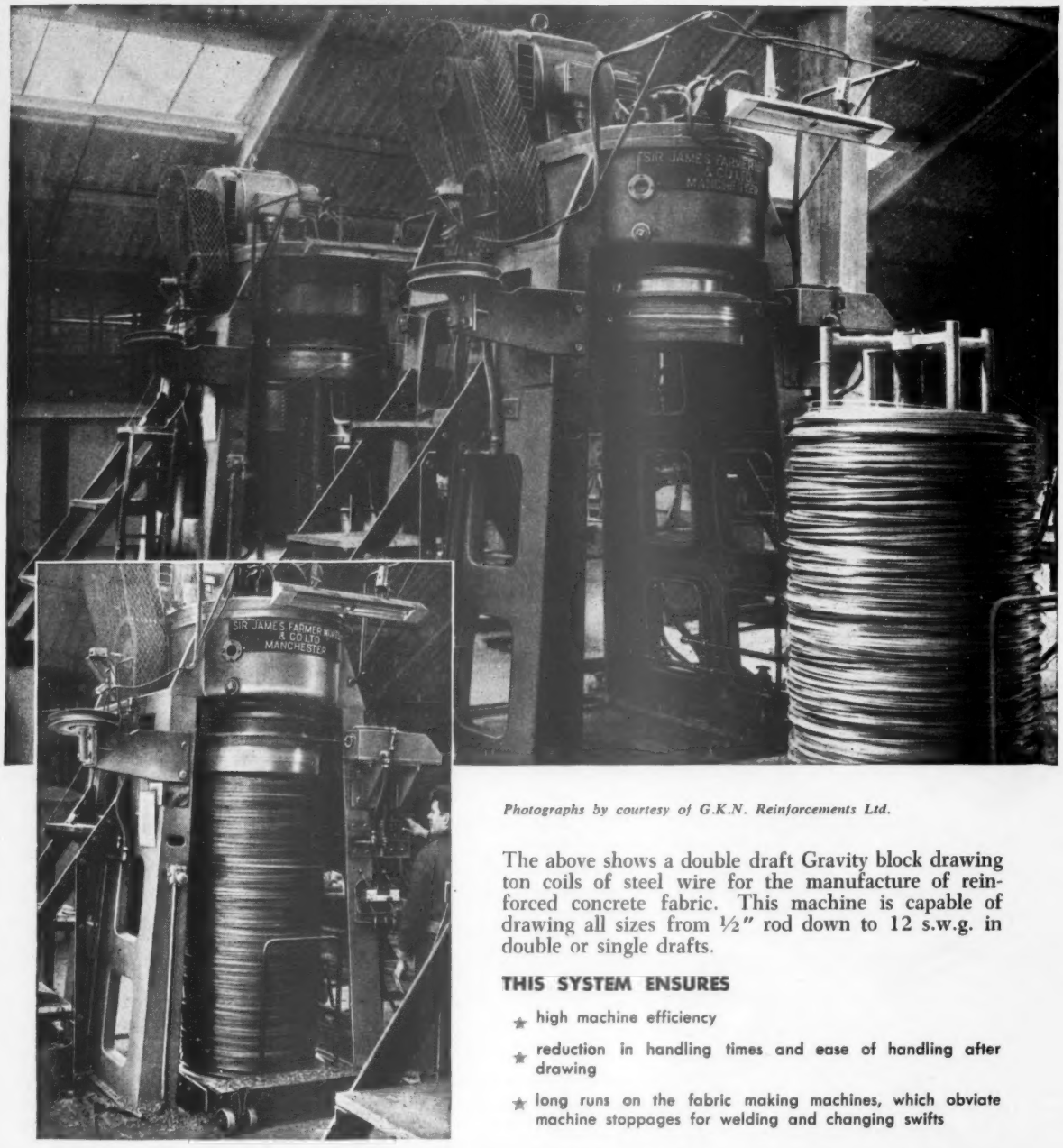
Send your orders to:

WIRE AND WIRE PRODUCTS

453 MAIN STREET **STAMFORD, CONN.**

(Exclusive distributors)

Farmer Norton



Photographs by courtesy of G.K.N. Reinforcements Ltd.

The above shows a double draft Gravity block drawing ton coils of steel wire for the manufacture of reinforced concrete fabric. This machine is capable of drawing all sizes from ½" rod down to 12 s.w.g. in double or single drafts.

THIS SYSTEM ENSURES

- high machine efficiency
- reduction in handling times and ease of handling after drawing
- long runs on the fabric making machines, which obviate machine stoppages for welding and changing swifts

Makers of all classes of Wire Drawing Machinery and pioneers of the inverted block system for handling large coil weights.

Sir James Farmer Norton & CO. LTD.

ADELPHI STREET • SALFORD • LANCASHIRE • ENGLAND

Sole Representative in U.S.A.: Steel & Wire Machine Co., 15457 Euclid Ave., Cleveland 12, Ohio. MUlberry 1-7151

What's the limit on cold-headed wire parts?

Some of these items cold-headed from wire exceed the supposed limits of just a few years ago; who can say how far the frontiers of cold-heading will be advanced in the next few years?

The key to cold-heading's phenomenal success is the wire metallurgy. Steel wire for cold-heading is a Bethlehem specialty, and our metallurgists have had years of experience. Bethlehem cold-heading-quality wire is made to rigid standards. It is uniform in analysis and free from injurious surface defects. Thorough inspection, at every stage of production, is behind every ton we ship.

At your invitation we will gladly study your products, equipment and process, and recommend the grade of steel that will perform the best. Then we'll carefully produce the steel to meet your needs.

Bethlehem makes nearly every kind of steel wire. Why not discuss your cold-heading or other production problems with one of our technical men? There are many ways in which our engineers might be able to help improve your production of cold-headed items. Just phone the nearest Bethlehem district sales office, or write direct to the address below.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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PRECISION WITH RUGGEDNESS

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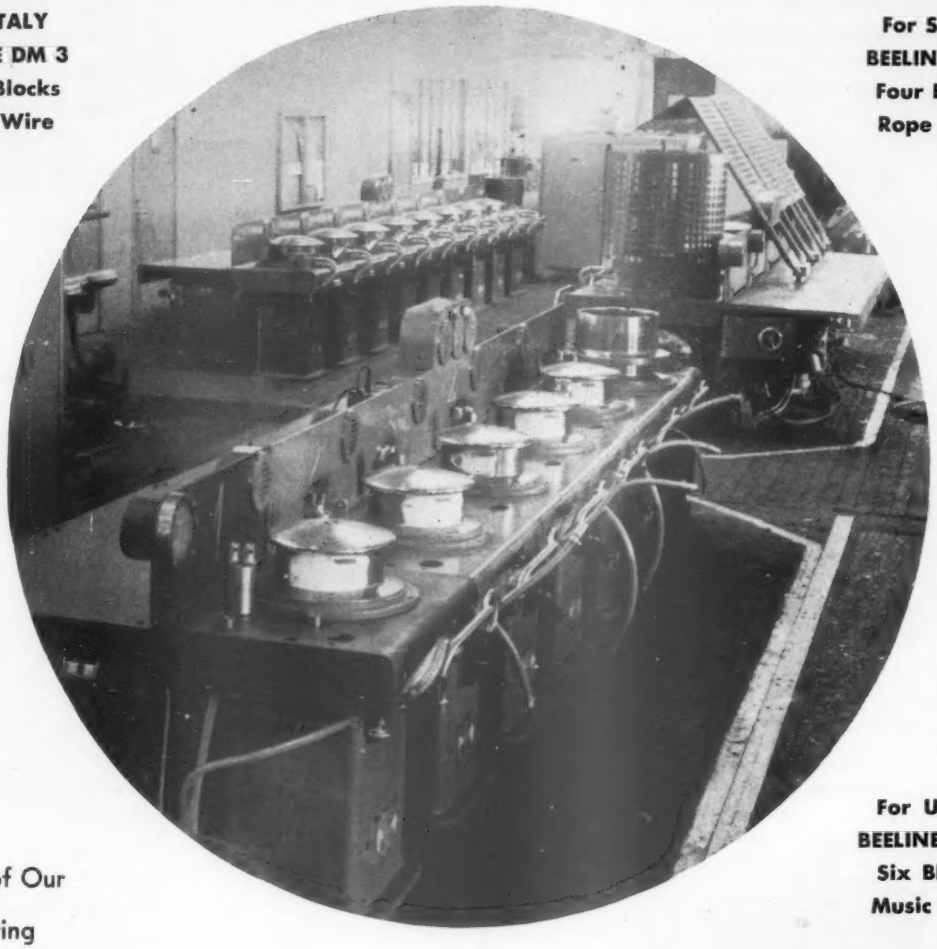
BEELINE DM 3
Nine Blocks
Rope Wire

For SPAIN
BEELINE DG 4
Four Blocks
Rope Wire



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BEELINE DM 3
Six Blocks
Music Wire

View of Our Testing Laboratories Machines are Thoroughly Production-Tested Before Delivery to Our Customers the WORLD Over

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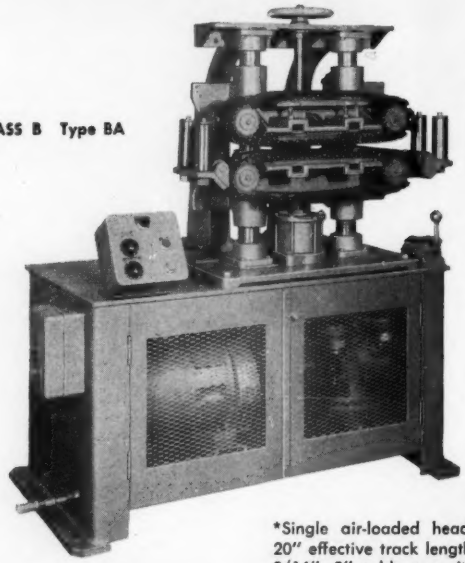
*Multiple air loading
*All right angle drives eliminated
45" effective track length • 3/16"—6" cable capacity
Maximum pull 4000 lbs. (At up to 90 F.P.M.)
650 F.P.M. maximum recommended operating speed
Floating track design • For inputs up to 15 H.P. maximum

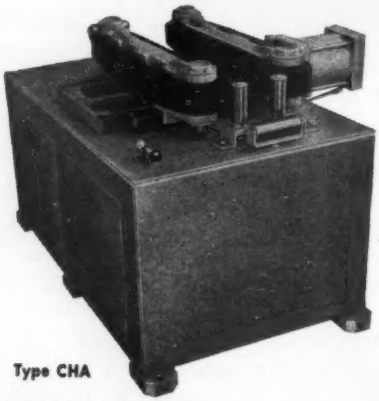
CLASS C
Type CV-DB-40

*Double air-loaded heads
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 65 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 20 H.P. maximum

CLASS B Type BA



*Single air-loaded heads
20" effective track length
3/16"—3" cable capacity
Maximum pull 700 lbs. (At up to 100 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 3 H.P. maximum



CLASS C Type CHA

*Single air-loaded head
Horizontal tread arrangement
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 60 F.P.M.)
For inputs up to 15 H.P. maximum

GENERAL INFORMATION

All units are available with readily interchangeable treads with a choice of durometers. Treads can be contoured to match cable diameter to minimize unit pressure. Units are available with or without drives.

ENTWISTLE
Manufacturing Corporation

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UNIFORM QUALITY of KEYSTONE WIRE means UNIFORM STAPLES for SPOTNAILS, INC.

Spotnails, Inc., Evanston, Ill. and Los Angeles, Calif., produces quality staples by the millions for use by building, crating, millwork and furniture industries. Mass production of these low-cost fasteners demands a quality wire that runs all day without a moment's trouble . . . and produces a staple with correct temper and uniformity for perfect continuous operation in automatic guns. Keystone galvanized preformed staple wire meets these specifications. Its uniform galvanized coating permits precision forming without flaking, and keeps the machines operating on a continuous basis.

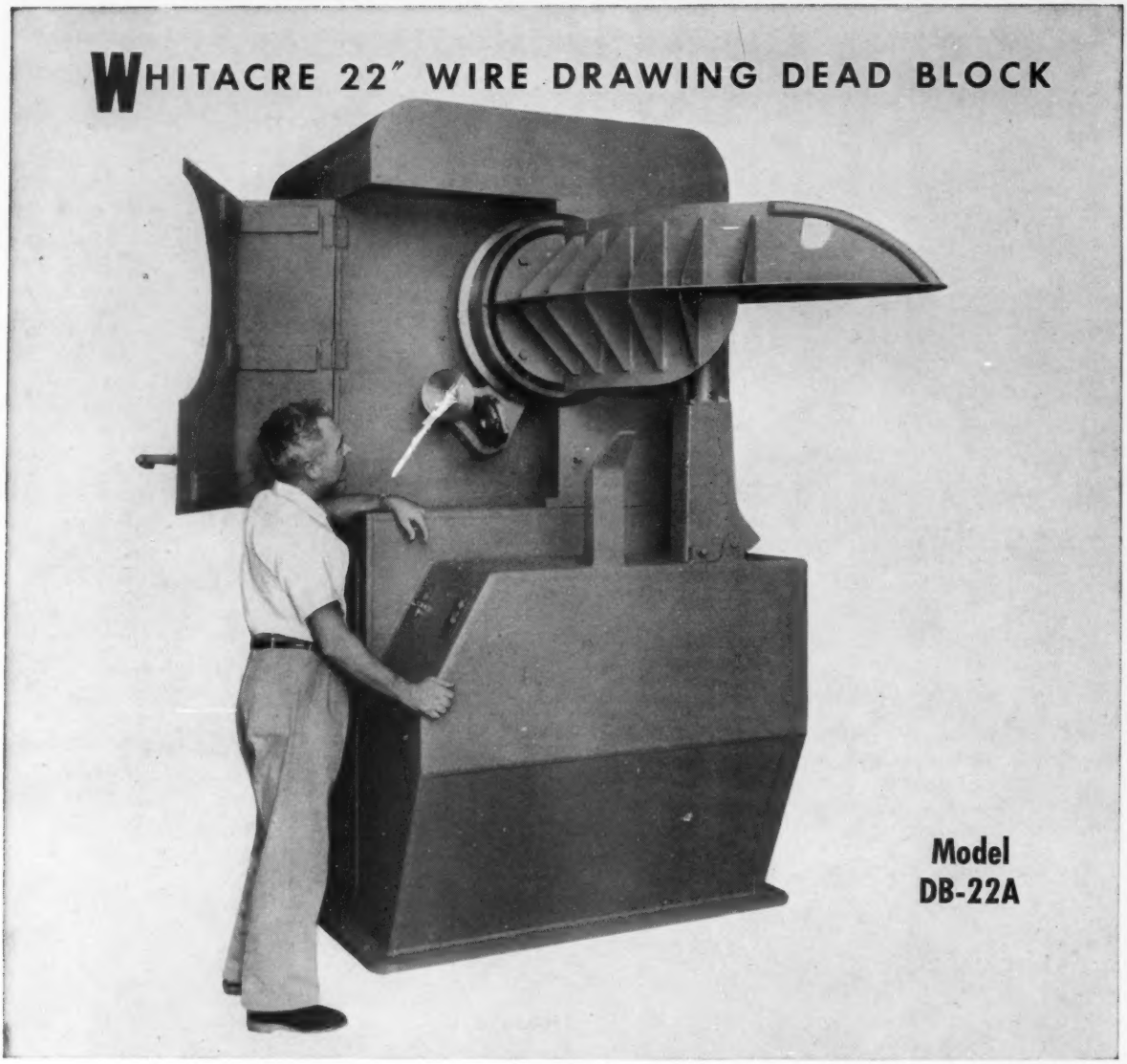
Keystone representatives work with Spotnails designers to produce wire with just the right qualities for mass production and perfect performance. This close, confidential cooperation is available to you, too. Tell us your wire forming problem—we'll help you solve it!

Keystone Steel & Wire Company, Peoria 7, Illinois

KEYSTONE

WIRE FOR INDUSTRY

WHITACRE 22″ WIRE DRAWING DEAD BLOCK



Model DB-22A

Continuous Production—Efficiency Approaching 100%

Gives you these advantages

Continuous increased production achieved by: • No down time for stripping • Permits packaging into stationary container or uninterrupted palletizing on stems • No tangling nor snarling from handling • Design simplicity. No back-gearing nor similar mechanisms • Greatly reduced floor space requirements • Dies in supplying drawing machine can be changed without stopping dead block • Accumulation type machines can be "run down" without stopping dead block • Continuous inspection and sampling • Breaks welded in production — low scrap loss • Increased production with lessened operator fatigue • Maintenance eliminated except for occasional lubrication of four main bearings and two motor bearings • Dead block can be located anywhere with wire literally piped from wire drawing machine • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

OTHER MODELS AVAILABLE

16″ Wire Drawing Dead Block, Model DB-16A • 26″ Wire Drawing Dead Block, Model DB-26A • Combination 16″ and 22″ Galvanizing or Tinning Dead Block Take-ups, Model GB-2216A • 26″ Heavy Wire Galvanizing or Tinning Dead Block Take-up, Model GB-26B.

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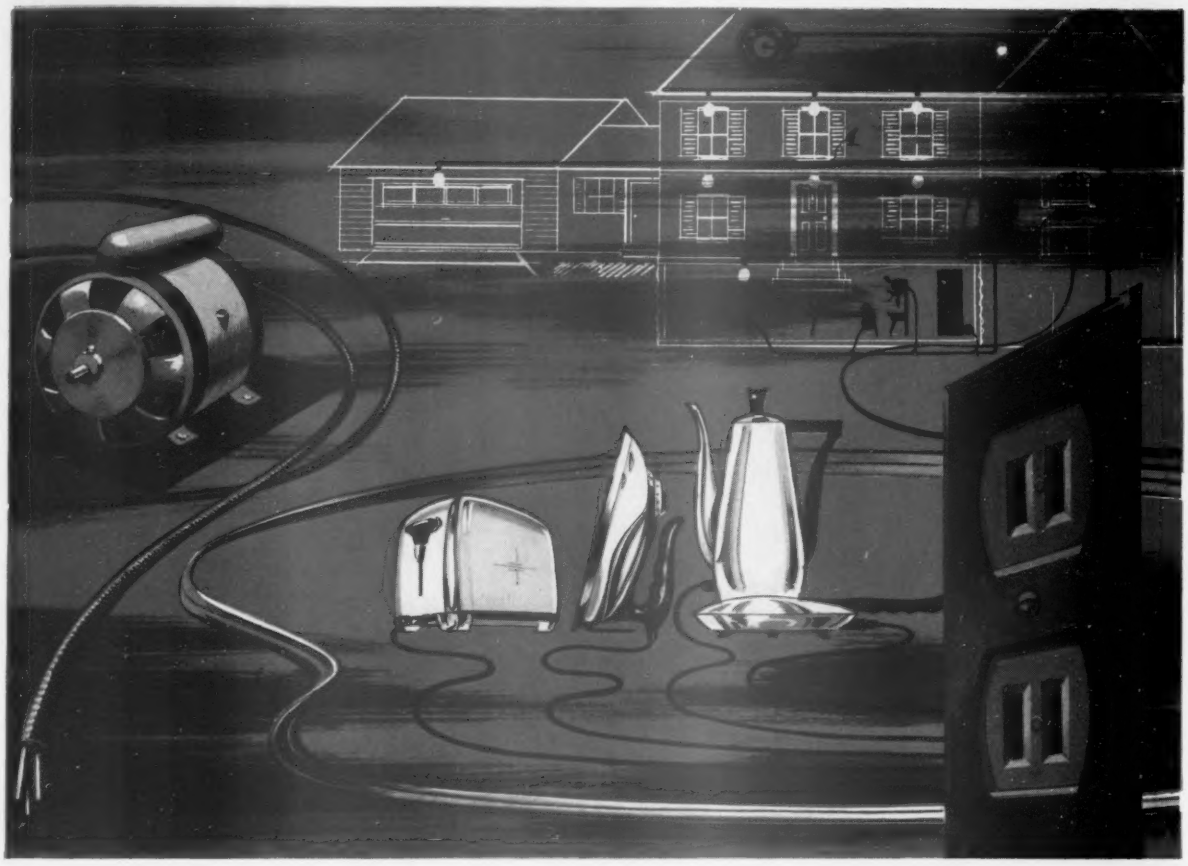
POLYVINYL CHLORIDE RESINS



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NAUGATUCK now offers the Wire and Cable Industry *more* PVC resins for insulation extrusion than does any other resin manufacturer.

Two of these Marvinol® resins, VR-22 and VR-23, have UL approval. These resins are, respectively, of high and intermediate molecular weight. Both have good dry blending properties.

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FINE WIRE
WET DRAW MACHINE
with Dead Block

MODEL FW-II DB

12"-16" FINISHING BLOCK
ADJUSTMENTS FOR CAST AND LAY
SELF-CONTAINED LUBRICANT SYSTEM
FILLS STANDARD OR SPECIAL PAY-OUT CONTAINERS

Inspect your wire while you draw
Ideal for direct shipments or process

wire ENGINEERING ASSOCIATES, INC.

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Midwest Representative: Bronson & Bratton Inc., Chicago 32, Illinois

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Cold-Headed Products like these . . .

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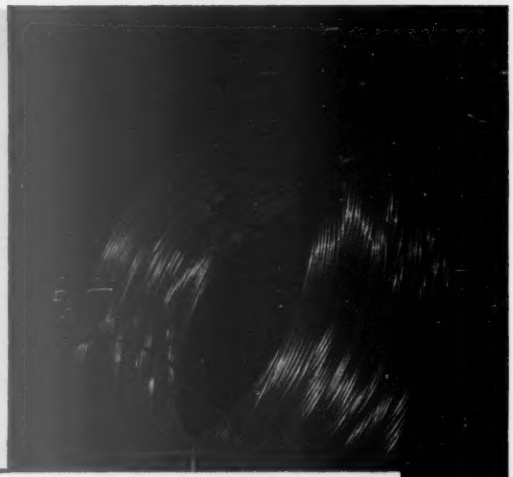
- Non-threaded, multi-diameter, head and shoulder parts, drilled or not drilled.
- Washer and binding head screws with rolled threads.
- Special design fastenings and other small parts of intricate shape, with or without requirements for drilling or threading.

. . . become "routine" with



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(Cartridge Brass, 70%)

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

IT ELIMINATES

1. OUT-OF-ROUND HEADS
2. INCOMPLETE FILLING-OUT OF HEADS AND SHOULDERS
3. ROUGH "ORANGE PEEL" EFFECT
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Scovill Cold-Heading Wire is extruded from CONTINUOUS-CAST brass billets by the hot extrusion process, then cold-drawn and annealed in accordance with closely controlled mill procedures.

CONTINUOUS CASTING produces *more uniform metal* than any other process, both in chemical composition and in freedom from casting flaws or other variations.

Scovill has standardized on *Cartridge Brass,* 70% for wire to be used in cold-heading operations. This alloy has a 5% HIGHER COPPER CONTENT than is generally found in brass cold-heading wire and is more ductile.

Prove this on your next wire order. Let us help you specify the proper closely controlled Scovill temper to produce more nearly perfect headed brass parts . . . whether you require "flow" characteristics for heading, or "flow" plus essential rigidity for secondary machining.

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The many new headings, new products, address changes and other important information changes in the listings of sources of bars, rods, wire, wire products, electric wire and cable and of sources for machinery, equipment and supplies used in the Wire Industry, make this directory

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LIST OF MEDAL AWARD WINNERS AND HONORABLE MENTION AWARDS.

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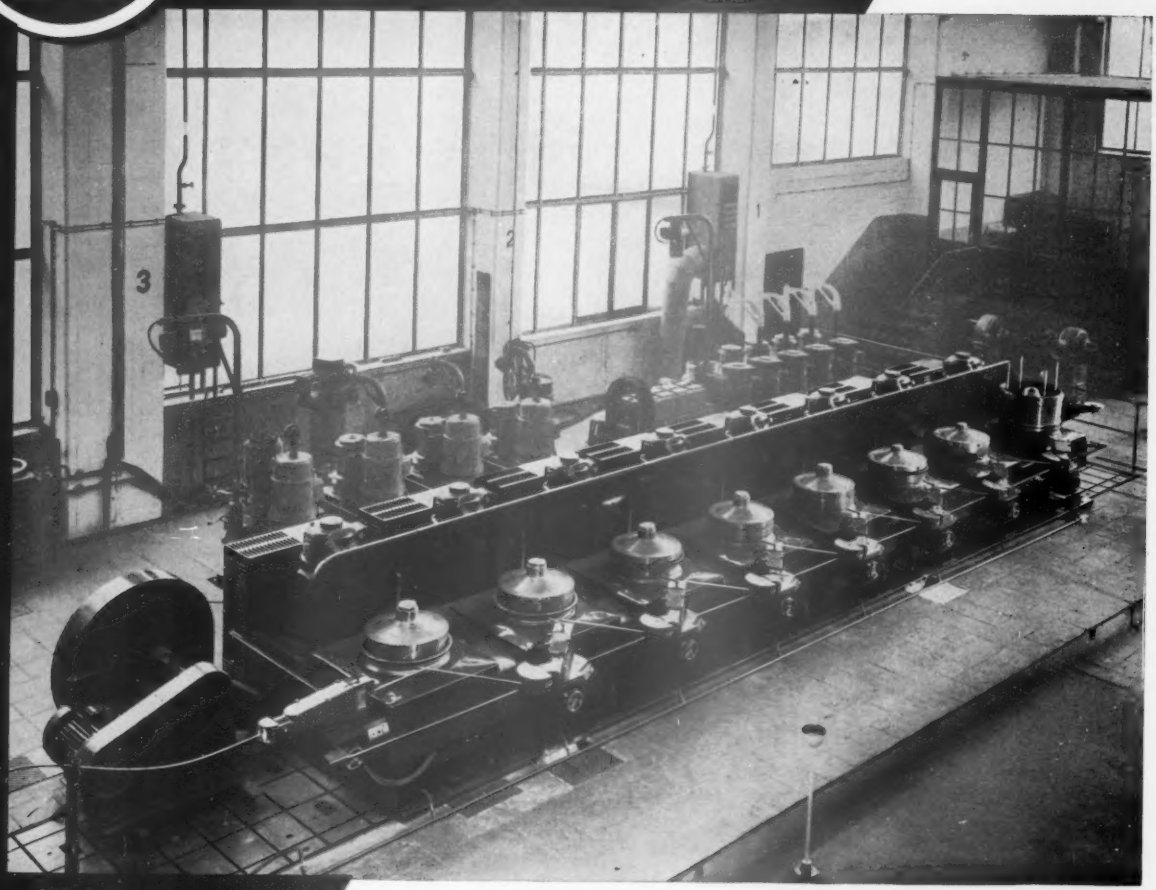
HERBORN



HERBORN straight-through wire drawing machine

model G Ia with power selective alternating current drive, with air- and water cooling system, for the drawing of medium and high carbon spring wire with starting size from 3/8" diameter.

Please send us your inquiries, we shall be glad to submit suggestions and proposals

MASCHINENFABRIK HERBORN
BERKENHOFF & DREBES A. G., HERBORN/GERMANY

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reaches many prospects

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Your advertising in Wire and Wire Products will be seen by many people in the plants you wish to "sell", whom your salesmen never would see, yet who specify, actually buy or who influence decisions on products to be purchased. Your advertising is bound to be of immeasurable value to you, too, in paving the way for a good reception for your salesmen when they do call. And the field's buying power is tremendous!

WIRE AND WIRE PRODUCTS circulation is all paid. We have no agents, offer no premiums or make special inducements to get circulation, except the value of the editorial contents in itself—yet our renewals have averaged 97% or better for many years. That's why it is a good and forceful advertising medium for all concerns who have products to sell to this vigorous and progressive industry.

Subscribers by Types of Mills in the Industry

1. Rod, Bar and Wire (producers of rod, bar and wire in all metals and shapes)	38%
2. Forming and Fabricating Plants (mfrs., largely from purchased wire, of springs, wire cloth, bolts, nuts, screws, rivets, wire forms, fences and fencing, wire specialties, wire rope and electric wire and cable)	59%
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1. Executives: Presidents, Vice Presidents, Secretary-Treasurers, Purchasing Agents, Sales Managers	22%
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WIRE and WIRE PRODUCTS

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Lamson & Sessions Expansion Includes Lee Wilson Annealing Furnaces

When the records are checked, leading rod and wire users the world over just naturally turn to Lee Wilson for the latest in annealing and spheroidizing equipment. That's the way it was with Lamson & Sessions Co. when it was decided to expand their Cleveland operations. They had used Lee Wilson furnaces for years, and their records satisfied them they had the finest.

Lee Wilson engineers suggested their new 114″ diameter high-convection furnaces that were proving so successful in other plants for processing 3 stems of rod coils per charge. Lamson & Sessions agreed and ordered two furnaces and four bases.

Initial results: Lamson & Sessions today is getting a finer, more uniform anneal and production rates have jumped to a record high.

If you're considering new rod or wire annealing equipment, be sure to talk to a Lee Wilson engineer about these great new 114″ furnaces.

Lee Wilson® ENGINEERING COMPANY, INC.
0005 LAKE ROAD • CLEVELAND 14, OHIO

HIGH CONVECTION ANNEALING FURNACES
MAKE THE BEST METALS BETTER

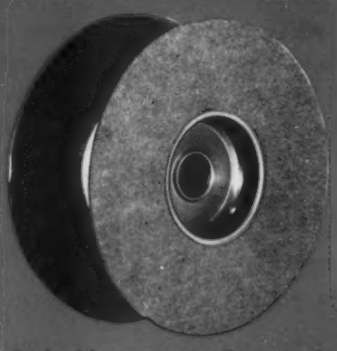
®ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES

HUBBARD HAS IT

If it's a spool or reel, HUBBARD makes it.

Every type: Wood - Steel - Plywood - Masonite - Cardboard - Aluminum.

HUBBARD is headquarters for any reel or spool requirement.



Reel with a masonite flange and cardboard hub assembled with steel end washers for domestic and export shipment of wire, tape, braid or other materials.

Heavy Duty Precision Brazed Steel Spool for drawing and processing of wire. Strongly and accurately made for long service.

Non-Returnable Magnet Wire Shipping Reels designed for high-speed wire take-off. Light in weight, low in cost, high in impact and tensile strength. Ideal for palletized shipments.

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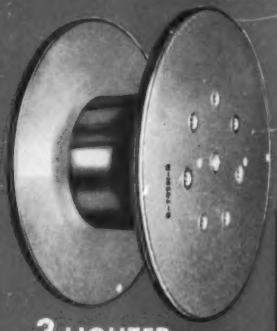
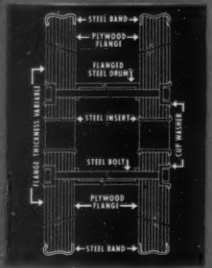


FOR BETTER SHOP REELS RESULTING IN

1 GREATER IMPACT STRENGTH

2 LOWER MAINTENANCE COSTS



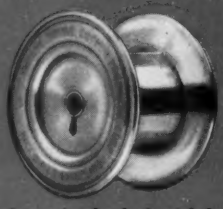
3 LIGHTER WEIGHT FOR EASIER HANDLING

4 ABILITY TO WITHSTAND SUBMERGENCE IN WATER

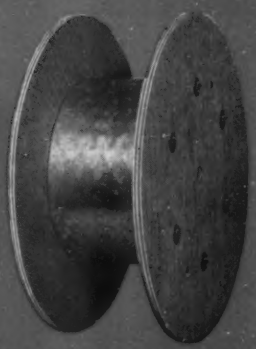
5 WIDE RANGE OF SIZES

Steel Shipping Containers. Wire Pak pails featuring top and bottom support for inner core. Smooth seams throughout. Tops available with lug or ring seals. Have salvage value.

Top quality wood reels armored with cadmium steel for maximum strength and long service.



Aluminum Reels designed for customers' appeal. Heads are strong. All welded construction. Smooth surfaces. Tare weight uniform. Ideal for bulk shipping.



Reel with plywood flange and galvanized steel hub assembled with tubular rivets and special washers for heavier loads.

HUBBARD SPOOL DIVISION

The American Pulley Company

TELEPHONE: GARRETT 840 **GARRETT, INDIANA**

The Wire Outlook

Business activity is registering gains and in all probability will follow a pattern of steady but moderate continued gains through the first half of the year.

Factories are enjoying bigger orders and people are spending more freely. In fact, buying on time has taken a big jump.

Steel production is moving ahead and is running at an average rate in excess of 75% of capacity. Should there be no steel strike, the prospect of which is diminishing, steel should be in ample supply for the balance of the year.

Manufacturers' inventories, which have been on a hand-to-mouth basis for some time, are starting to build up and by Fall a marked trend in this direction should be noted. The backlog of unfilled orders at the end of the year had inched up one point to 46.8 billion dollars, 38 percent higher than last July, while factory inventories start at 4.2 billion less than a year ago.

Auto sales, somewhat slowed by bad Winter weather, are still 20% over those of 1958 for the same period and if the Spring demand lives up to expectation, this will help not only the wire industry, but business in general. About two-fifths of the cars sold are purchased on credit, contributing considerably to the new all-time high in installment buying.

The outlook for building in 1959 continues good. The trend is toward larger houses with more rooms—an average of 4 as against 3 for the last several years. The year should record a mild boom in home construction, with about 1.3 million starts.

Hourly wages had moved up to an average of $2.19 by the end of 1958, which was 4½ percent, or 9 cents an hour, higher than in December, 1957.

Corporate profits are looking good once more, and are highly satisfactory compared with the 1958 showings for the first three quarters. By Spring, these profits are expected to be running at the record rate of $50 billion a year.

Among the lines that are showing the most marked improvement are steel, aluminum, autos, and building materials, which includes house wiring. While few industries are doing a boom business, the important fact is that sales are moving up. A recent survey among executives showed that 3 out of 10 expect no increase this year, while the average outlook of the balance is for a 10 percent gain in sales.

Expansion of production facilities is again having some attention, the steel industry in particular, which will spend over a billion dollars this year in new construction. Some of this is in modernization projects, through which more goods with less help can be turned out. Labor may not like it, but their insistent demands have forced the issue. More efficient machines are needed just to offset rising costs.

Manufacturers' wire is among the strong items, but cold heading, fastener and upholstery wires are also giving a good account of themselves. While wire mills are booking more orders, prompt deliveries have not had to be curtailed. Merchant wire product sales, seasonably off during the Winter, should begin soon to take up some of the slack in the mills' open schedules.

The electric wire and cable mills have been busy, their activity having carried through the recession period better than their steel friends. The brass mills, on the other hand, who have had tough going for several years, are now getting more business. Copper alloy rods are among the more active brass mill products.

Business has recovered from its recession losses. The country is moving into an era of growth—possibly the greatest in its history. Expanding population, new industrial materials and products, new processes and equipment, and a marked increase in family income will all be factors in the development of industrial growth in the years ahead.

Edmund Duval Sickels
EDITOR

Feb. 1956
Client requests lowest friction lubricant for titanium and zirconium rod drawing.

Apr. 1956
R. H. Miller Co. representative submits three most widely used Steelskin compounds; will cooperate with client in tests to find best mixture.

June 1956
Steelskin compound successful; client beginning machinery build-up.

Dec. 1956
Steelskin special mixture adopted; client placing regular orders on basis of test results.

Jan. 1957
Client reports exceptional results; increases orders to large production quantities. CUSTOMER SATISFIED, BUT OUR RESEARCH STAFF TO CONTINUE EXPERIMENTING.

Feb. 1957
Company researchers announce final refinement of this special Steelskin compound. Customer production tests prove product superior. Customer standardizes on our improved compound.

CASE HISTORY

Re: Johnston & Funk Metallurgical Corp.

—from the files of

R. H. MILLER COMPANY

"After much research with drawing compounds and lubricants for the drawing of titanium metal, which has peculiar characteristics, we found your special 'STEELSKIN' Compound the only lubricant which really does the job," said a Company spokesman.

This Steelskin story typifies the teamwork and service which has made 'STEELSKIN' a watchword with manufacturers who require the best in wire drawing compounds, powders, greases and coatings. This was a unique problem requiring the attention of specialists—so naturally they turned to R. H. Miller Company, specialists in top quality wire drawing lubricants for 50 years.

From the time our client realized the need for a new compound for drawing titanium and zirconium rod, until they reached full production, an R. H. Miller representative was on the job, cooperating in every phase of the development.

This representative liaison between R. H. Miller Company and *each* of its clients assures us the first-hand information vital to our product development and perfection.

And your R. H. Miller representative is your assurance of skilled attention to your wire drawing needs. Call him. He's as near as your telephone.

Finest in lubricants for 50 years.

R. H. MILLER COMPANY, INC., Homer, N. Y.

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METAL WORKING LUBRICANTS

WIRE
AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 34 MARCH, 1959 No. 3

Contact Stresses in Wire Ropes

by Dr. Arthur W. Leissa
Assistant Professor
Department of Engineering Mechanics
The Ohio State University
Columbus, Ohio

This article embodies the result of research concerning the theoretical stress analysis of 6 × 7 wire rope subjected to a pure tensile load, in which the radial forces between strands and between individual wires in each strand are expressed as a function of the tensile loading and geometry of the rope.

Introduction

Wire rope has been used for many decades for many purposes such as suspension bridges, mine hoisting, aerial tramways, and the mooring of ships. Its importance is universally recognized, especially in the fields of mechanical and structural design.

★ ★ ★

Yet, despite the importance of the wire rope, comparatively little is known about its critical stresses. Manufacturers have carried out extensive tests to determine the breaking strengths of their products, yet they do not understand the mechanisms which cause failure. The use of confusing terms such as "reserve strength" is resorted to in order to explain the capabilities of a particular wire rope. Extensive tests have been carried out to find the effect on the strength of wire rope of bending it about a sheave. From these results, many sets of data on minimum recommended drum diameters for various sizes and types of wire rope have been obtained.

★ ★ ★

However, this work is practically all of an experimental nature, with very little explanation attempted upon the fundamental causes of failure. Because of the little knowledge on the subject of stresses in wire ropes, it is necessary to use very large factors of safety to insure the satisfactory and safe use of wire rope. As a result, in many applications, inefficiency in the use of steel must be resorted to in order to protect both equipment and people. While a complete stress analysis of existing wire ropes cannot make these ropes safer, it can be appreciated that once the phenomena involved are understood, steps can be taken to create designs which use the material of the wire rope more effectively.

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To the author's knowledge, there is no previously published work which attempts a complete stress analysis of a wire rope. The complexity of the problem seems to appear overwhelming to the great majority of people who are interested in it. For example, in the work by Suslov,[1] the statement is made that a mathematical calculation of stresses by the theory of elasticity is impossible "owing to a great number of unknown changeable units which enter as a part in the solution of such a problem."

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Thus, for many years little attempt was made to understand the problem. The wire rope was calculated to fail by direct tensile stress. This stress was calculated by dividing the total load which was applied on a rope at the point of failure by the cross-sectional area of metal in the rope.

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The year 1945 marked an important advance in the stress analysis of the wire rope. In that year a paper was presented by Drucker and Tachau[2] which was the result of extensive fatigue testing of several types of wire rope. The results of their work showed that there was no correlation between the fatigue life of a

1 The numbers appearing as superscripts throughout this manuscript refer to the references given at the end of the paper.

rope and either the direct tensile stress or the bending stress induced by bending the rope about a pulley. On the other hand, there was a very good correlation between rope life and the compressive stresses at the points of contact between the wire rope and the pulley. This work was based on experimental evidence. It opened the door to a new concept of the cause of failure in a wire rope; i.e., high compressive stresses at points of wire-to-wire contact.

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Another advance was made in 1951 when Hruska[3] showed that the direct tensile stress in the core wires of the strands of the wire rope is higher than in the remainder of the wires. In 1952, he wrote a further enlightening article[4] in which he discussed the radial force in wire ropes and derived an important relationship between the radial force and the tensile force. However, the accent of the latter work was on the effects of types of ropes and pulley diameters on radial loads, and little attempt was made to consider the actual stresses.

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While the work of Messrs. Drucker, Tachau, and Hruska is far from being a complete study of the stress picture of the wire rope, their work must certainly be applauded, for it opened a new field of thinking on the problem. From their work, the importance of compressive contact stresses is beginning to be appreciated. That the effects of compressive stresses are beginning to be appreciated is seen in articles in which methods are being proposed to eliminate critical contact points. The work of Herbst[5] suggests a method of rope manufacture which avoids the crossing of wires and resulting points of contact. Another paper by Richards[6] suggests the use of a core wire of the cross-section of an equilateral triangle in individual strands, thus presenting more contact area between adjacent strands.

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The author became interested several years ago in the problem of the contact stresses arising in wire ropes and conducted research[7] in an effort to shed further light upon this subject. This study concerned the theoretical stress analysis of a 6 x 7 wire rope subjected to a pure tensile load. The 6 x 7 configuration was chosen because of its relative geometrical simplicity when compared with other designs, although the method of analysis employed would be readily extendible to others as well. The results of this work are discussed in the remainder of the paper which follows.

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In the analysis of the 6 x 7 wire rope, regions of critical stress appear in two places. The first ones to be considered are those arising along the lines of contact between the individual wires in a strand. The others occur between adjacent wires in neighboring strands of the wire rope.

Stress Analysis of the Critical Regions Between Wires of a Single Strand

Consider first a single strand of a 6 x 7 wire rope consisting of six outer wires and a core wire all under a tensile loading T as shown in Figure 1. It was shown by

Figure 1

Hruska[3] that if the strand is elongated by any amount, the tensile stresses due to the direct loading are greater in the core wire than in the outer wires. This relationship is given by

$$\sigma_c = \frac{\sigma_o}{\cos^2 \alpha}, \quad (1)$$

where: σ_c = stress in core wire
σ_o = stress in outer wires
α = lay angle (90 degrees minus the helix angle).

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But summing the forces in all wires in the direction of the strand axis gives

$$T = \sigma_c \frac{\pi d^2}{4} + 6 \sigma_o \frac{\pi d^2}{4} \cos \alpha \quad (2)$$

where d is the wire diameter. Then combining equations (1) and (2) gives

$$T = \sigma_c \frac{\pi d^2}{4} (1 + 6 \cos^3 \alpha). \quad (3)$$

Hruska[4] also derived the expression for the radial force exerted by a negligibly thin wire upon a cylinder about which it is wrapped in a helix. This relationship is given by

$$F_R = \frac{T \sin^2 \alpha}{r}, \quad (4)$$

where:
F_R = radial force, lb per inch
T = tension per wire, lb
α = lay angle of wire, degrees
r = radius of cylinder about which wire is wrapped, in.

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This expression can be used as a reasonable approximation for this case in which the outer wires are wrapped around a core wire of the same size. In terms of this situation, the radial force is given by

$$F_R = \frac{\sigma_o \frac{\pi d^2}{4}}{d} \sin^2 \alpha. \quad (5)$$

Simplifying, and substituting equations (3) and (4) into (5) results in

$$F_R = \frac{T \cos^2 \alpha \sin^2 \alpha}{d(1 + 6 \cos^3 \alpha)}. \quad (6)$$

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At this point it will be necessary to analyze the effects of this radial force on a strand of the 6 x 7 wire rope. Figures 2(a) and 2(b) show the cross-section of a strand with the two possible distributions of forces resulting from the radial forces. In Figure 2(a) it is assumed that the core wire is slightly larger than the outer wires; thus the radial force of each wire is concentrated along the line of contact between the inner and outer wire.

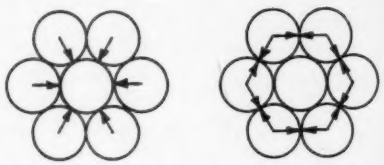

Figure 2

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In Figure 2(b) it is assumed that the core wire is slightly smaller than the outer wires; consequently, the forces will be distributed in the "hoop" manner as shown. From the geometry of the rope, it is evident that each of these forces between adjacent

wires will be equal in magnitude to the radial force.

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It is quite plausible that either or both of the two conditions discussed above can occur in a wire rope because of the fact that the manufactured wire requires a tolerance. Even though manufacturing tolerances are usually quite small for cold drawn wire, variations on the order of ten-thousandths of an inch will cause these conditions to occur. While it is possible to achieve such a near-perfect condition that the forces could be distributed in a manner which would be a combination of these two extremes, it is obvious that such a condition could not give rise to contact stresses as high as either of the two conditions discussed above. Furthermore, in arriving at design equations, one must consider the worst possible conditions which might arise to cause failure.

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As it has been shown, the forces between lines of contact are equal in magnitude for both of the conditions. Similarly, the compressive stresses induced in these two cases will be equal. However, it was seen earlier that the tensile stress in the core wire will be higher than in the outer wires for any load. Thus, maximum shearing stresses will be present for the condition shown in Figure 2(a). Since the maximum normal stresses of 2(a) will be equal to those of 2(b) and the maximum shearing stresses will be higher, we can eliminate the condition of 2(b) as a critical condition.

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With the critical regions now determined, the next step is to determine the stresses due to the loads at these places. Besides the direct tensile stress in the core wire, there will be three principal compressive stresses due to the Hertz effect at the line of contact. The assumption will be made here that the line contact between outer wires and the core wire results in the same type of compressive stresses as two cylinders in line contact; i.e., with their axes parallel.

From the text by Seeley and Smith,[8] the following equations are taken which give the three principal compressive stresses due to the compressive radial force as a function of the load, geometry, and elastic properties of the material.

$$\sigma_x = -2\mu\left[\sqrt{1+(z/b)^2} - \frac{z}{b}\right]\frac{b}{\Delta} \quad (7)$$

$$\sigma_y = -\left[\frac{\left(\sqrt{1+(z/b)^2} - z/b\right)^2}{(1+(z/b)^2)^{+1/2}}\right]\frac{b}{\Delta} \quad (8)$$

$$\sigma_z = -\left[\frac{1}{(1+(z/b)^2)^{+1/2}}\right]\frac{b}{\Delta} \quad (9)$$

where:

σ_x = principal stress in axial direction.
σ_y = principal stress in tangential direction.
σ_z = principal stress in radial direction.
μ = Poisson's ratio.
z = distance below the surface to the point under consideration.

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The quantity b has the physical significance that it is one-half of the width of the rectangular area of contact formed when a radial load is placed on two cylinders with parallel axes. The equation relating b with the load, geometry, and elastic properties of the material is:

$$b = \sqrt{\frac{2 F_R \Delta}{\pi}}, \quad (10)$$

where F_R is the radial force.

★ ★ ★

The quantity Δ is a function of the geometry and elastic properties of the material. The equation showing their relationship is:

$$\Delta = \frac{1}{\frac{1}{2R_1} + \frac{1}{2R_2}}\left[\frac{1-\mu_1^2}{E_1} + \frac{1-\mu_2^2}{E_2}\right], \quad (11)$$

where:

R_1 = radius of curvature of one of the cylinders.
R_2 = radius of curvature of the other cylinder.
μ_1 = Poisson's ratio for the first cylinder.
μ_2 = Poisson's ratio for the second cylinder.
E_1 = modulus of elasticity for the first cylinder.
E_2 = modulus of elasticity for the second cylinder.

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In this case the wires are of the same material and have the same diameter. Therefore, equation (11) reduces to:

$$= \frac{d}{2}(1-\mu^2). \quad (12)$$

The equation for b becomes:

$$b = \sqrt{\frac{2d(1-\mu^2) F_R}{\pi E}}. \quad (13)$$

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An examination of equations (7), (8), and (9) shows that the maximum value of each of these stresses occurs when z = O, that is, at the surface of the wire. The minus signs before the right sides of these equations is to indicate that these stresses are compressive. Thus, we have seen that the maximum principal normal stresses are at the surface. Equations (7), (8), and (9) then become:

$$\sigma_x\big|_{z=0} = -2\mu(b/\Delta) \quad (14)$$

$$\sigma_y\big|_{z=0} = -b/\Delta \quad (15)$$

$$\sigma_z\big|_{z=0} = -b/\Delta \quad (16)$$

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To equation (14) must be added the direct tensile stress, σ_{dt}, which is in the axial direction. Equation (14) then becomes:

$$\sigma_x\big|_{z=0} = -2\mu(b/\Delta) + \sigma_{dt}. \quad (17)$$

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According to the maximum shear stress theory, failure occurs if:

$$\begin{aligned} \sigma_x - \sigma_y &= \sigma_f \\ \sigma_y - \sigma_z &= \sigma_f \\ \sigma_z - \sigma_x &= \sigma_f \end{aligned} \quad (18)$$

Again, the direct tensile stress must be added in the axial direction. Doing so, these equations become:

$$(\sigma_x + \sigma_{dt}) - \sigma_y = \sigma_f \quad (19a)$$

$$\sigma_y - \sigma_z = \sigma_f \quad (19b)$$

$$\sigma_z - (\sigma_x + \sigma_{dt}) = \sigma_f \quad (19c)$$

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Assuming that the material is steel, with a modulus of elasticity of 30 x 10^6 psi and a Poisson ratio of 0.26, the shear stress functions expressed in equations (18) have been evaluated for various depths below the surface, expressed as z/b. The relative values of these stresses have been plotted in Figure 3. $\sigma_x - \sigma_z$ has been plotted, instead of $\sigma_z - \sigma_x$, so as to give positive values for this shear stress

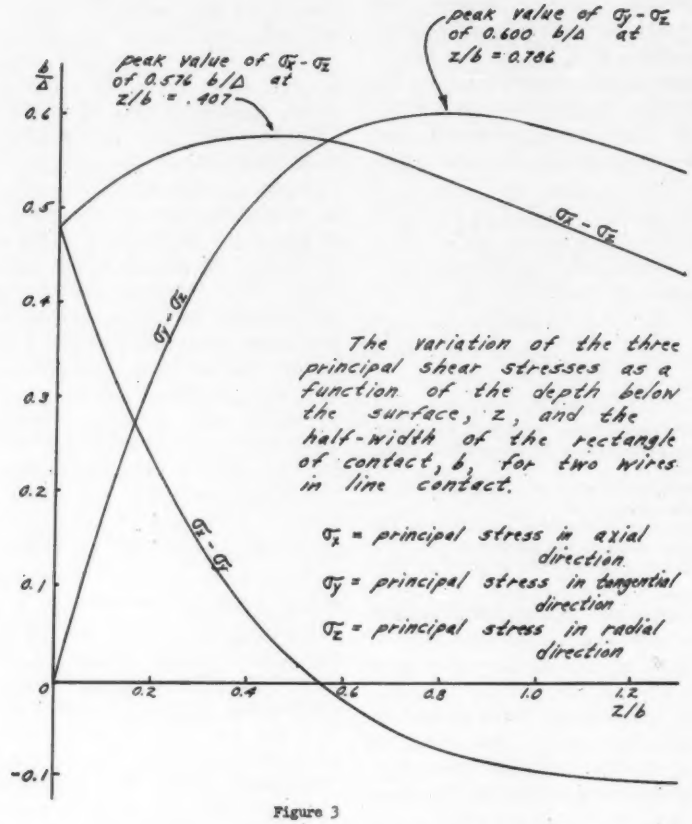
peak value of $\sigma_x - \sigma_z$ of 0.576 b/△ at z/b = .407
peak value of $\sigma_y - \sigma_z$ of 0.600 b/△ at z/b = 0.786
b/△
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
0.2
0.4
0.6
0.8
1.0
1.2
z/b
$\sigma_x - \sigma_z$
$\sigma_y - \sigma_z$
$\sigma_z - \sigma_z$
The variation of the three principal shear stresses as a function of the depth below the surface, z, and the half-width of the rectangle of contact, b, for two wires in line contact.
σ_x = principal stress in axial direction
σ_y = principal stress in tangential direction
σ_z = principal stress in radial direction

Figure 3

function.

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There are several interesting things to note from the curves of Figure 3. Since we saw that σ_y and σ_z are equal when z = O from equations (15) and (16), the curve of $\sigma_y - \sigma_z$ verifies this fact at z/b = O. The curves of $\sigma_x - \sigma_z$ and $\sigma_y - \sigma_z$ have peaks at positive values, $\sigma_x - \sigma_z$ having a peak value of 0.576 b/△ at z/b = 0.407 and $\sigma_y - \sigma_z$ having a peak value of 0.600 b/△ at z/b = 0.786. In other words, $\sigma_x - \sigma_z$ reaches a maximum very nearly equal to that of $\sigma_y - \sigma_z$ and at a point much nearer the surface. The curve of $\sigma_x - \sigma_y$ is seen to drop rapidly from positive to negative values and finally reach a minimum of about – 0.1 b/△. As z/b gets larger beyond the value 1.3, one can easily see that all three curves will tend towards b/△ = O.

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Still another phenomenon to be observed is the effect of adding the direct tensile stress to these curves. This direct tensile stress is independent of the depth z. From equations (7), (8), and (9), it can be seen that b/△ is directly proportional to stress. The addition of the direct tensile stress will cause the curves of $\sigma_x - \sigma_z$ and $\sigma_x - \sigma_y$ to be shifted upward since the direct tensile stress is positive and in the x-direction (axial). The curve of $\sigma_y - \sigma_z$ will not be affected since neither σ_y nor σ_z are in the direction of the direct tensile stress. Two important conclusions are apparent. First, since the $\sigma_x - \sigma_z$ function reaches a peak value nearly equal to that of the $\sigma_y - \sigma_z$ function, the addition of a comparatively small direct tensile stress will cause $\sigma_x - \sigma_z$ to peak at a higher value than $\sigma_y - \sigma_z$. Second, since the addition of direct tensile stress can only shift the curve of $\sigma_x - \sigma_y$ upwards, $\sigma_x - \sigma_y$ can never become greater than $\sigma_x - \sigma_z$. From this discussion, then, it is seen that the superposition of the direct tensile stress causes the $\sigma_x - \sigma_z$ stress to become the critical stress.

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We now have equations for the maximum normal stress and the maximum shear stress in a strand of the 6 x 7 wire rope due to the radial force exerted between the outer wires and the core wire expressed as functions of b/△. It would be desirable to find b/△ as a function of the load, geometry, and elastic properties of the material.

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Dividing both sides of equation (10) by △:

$$\frac{b}{\Delta} = \sqrt{\frac{2\,F_R}{\pi \Delta}} \quad . \qquad (20)$$

★ ★ ★

Substituting equations (6) and (12) into equation (20) gives:

$$\frac{b}{\Delta} = \sqrt{\frac{2\,T\,(\cos^2 \alpha)\,(\sin^2 \alpha)\,(E)}{d^2\,(1 + 6\cos^3 \alpha)\,\pi(1-\mu^2)}} \qquad (21)$$

★ ★ ★

From equation (3)

$$\sigma_{dt} = \frac{4\,T}{\pi\,d^2\,(1 + 6\cos^3 \alpha)} \qquad (22)$$

where σ_{dt} is the direct tensile stress in the core wire.

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Substituting this into equation (21) gives:

$$\frac{b}{\Delta} = \sqrt{\frac{(\cos^2 \alpha)\,(\sin^2 \alpha)\,(E)\,(\sigma_{dt})}{2\,(1-\mu^2)}} \qquad (23)$$

★ ★ ★

Assuming the material is steel, μ = 0.26, and E = 30,000,000 psi, the equation becomes,

$$\frac{b}{\Delta} = 4010\sqrt{(\cos^2 \alpha)\,(\sin^2 \alpha)\,(\sigma_{dt})} \qquad (24)$$

★ ★ ★

As a numerical example of the relationship obtained between direct tensile stress and the stress due to the Hertz effect, let us assume a value of lay angle α. Let it be 15°.

$$\text{Then, } \frac{b}{\Delta} = 1006\sqrt{\sigma_{dt}}\,, \qquad (25)$$

$$\text{or} \quad \sigma_{dt} = 9.89 \times 10^{-7}\,(b/\Delta)^2 \qquad (26)$$

But we have previously shown that

$$(\sigma_x - \sigma_z)_{max.} = 0.576\,(b/\Delta)\,. \qquad (27)$$

Therefore, equation (19c) becomes:

$$0.576\,(b/\Delta) + 9.89 \times 10^{-7}\,(b/\Delta)^2 = \sigma_f \quad . \qquad (28)$$

If a value of σ_t be assumed as the failure strength of the material, $(b/\triangle)$ can be solved for by means of the quadratic formula. This value of $(b/\triangle)$ can then be put back into equation (26) to find the value of the direct tensile stress at failure. Likewise, this value may be put back into equation (27) to find the value of the Hertz stress at failure. As a check, these two stresses should add up to σ_t. To find the significance of the Hertz stress at the failure point, one can examine the ratio of the direct tensile stress to the failure stress at the failure point to determine what percentage of the failure stress is due to direct tension.

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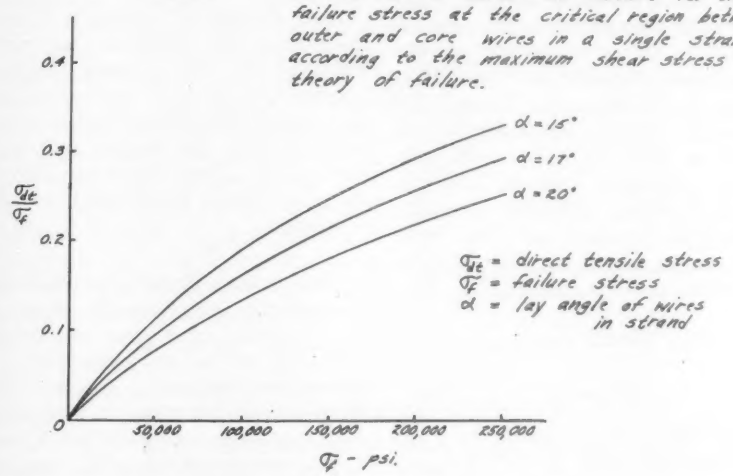
The curves of Figure 4 show the variation in (σ_{dt}/σ_t) for various values of σ_t and the lay angles, 15°, 17°, and 20°. It can be seen that the ratio (σ_{dt}/σ_t) decreases as α increases, which is what one might expect.

Figure 4 — The ratio of the direct tensile stress to the failure stress at failure vs. the failure stress at the critical region between outer and core wires in a single strand according to the maximum shear stress theory of failure.



Thus, it has been shown that for commonly encountered values of failure stress and lay angle, the shear stress due to the Hertz effect is far more significant than the shear stress due to the direct tensile stress.

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It is desirable to apply a similar type of analysis using the maximum normal stress theory, which is particularly applicable for brittle materials. It will be recalled that the maximum normal stresses occur at the surface, where z = 0. They can be expressed by the following equations.

$$\sigma_x = -2\mu(b/\triangle) + \sigma_{dt} . \quad (29)$$

$$\sigma_y = -b/\triangle . \quad (30)$$

$$\sigma_z = -b/\triangle . \quad (31)$$

★ ★ ★

By equation (23) it can be seen that:

$$\sigma_{dt} = \left[\frac{2(1-\mu^2)}{(\sin^2\alpha)(\cos^2\alpha)(E)}\right]\left[\frac{b}{\triangle}\right]^2 \quad (32)$$

★ ★ ★

Since $2\mu = 0.52$, it is obvious that σ_x can never become more negative than σ_y or σ_z. However, it is mathematically possible that σ_{dt} may become large enough that σ_x becomes large in the positive direction and larger in absolute value than σ_y or σ_z. To determine an order of magnitude of σ_{dt} necessary to accomplish this, let us assume a common lay angle of 17°, $\mu = 0.26$, and E = 30,000,000. Then, by equation (32),

$$\sigma_{dt} = 7.93 \times 10^{-7} (b/\triangle)^2.$$

★ ★ ★

Obviously then, $b/\triangle$ must become very large for σ_x to become equal to σ_y or σ_z in absolute value. The equation expressing this is:

$$-2\mu(b/\triangle) + 7.93 \times 10^{-7} (b/\triangle)^2 = |-b/\triangle| . \quad (33)$$

★ ★ ★

Solving this equation for $(b/\triangle)$ results in $(b/\triangle) = 6.05 \times 10^5$. However, if $(b/\triangle)$ becomes 605,000, σ_y and σ_z will become equal to –605,000 psi which is much higher than any acceptable failure stress for steel wire. Thus, we can eliminate σ_x from further consideration as a critical principal normal stress. The maximum normal stress is then at the surface and equal to $(-b/\triangle)$.

★ ★ ★

For a particular example, let us again assume $\alpha = 15°$.
Then

$$(b/\triangle) = 1006\sqrt{\sigma_{dt}}$$

or

$$\sigma_f = -1006\sqrt{\sigma_{dt}}$$

$$(\sigma_f)^2 = 1.012 \times 10^6 \sigma_{dt}$$

$$\frac{\sigma_{dt}}{\sigma_f} = 9.88 \times 10^{-7} \sigma_f .$$

★ ★ ★

This shows that the ratio (σ_{dt}/σ_t) varies linearly with σ_t. This curve and similar ones for lay angles of 17° and 20° are shown in Figure 5.

Stress Analysis at the Critical Regions Between Adjacent Strands

Having considered the critical regions between the outer wires and core wire of a single strand, the next step will be to determine the existence of other critical points in the wire rope. In this type of wire rope, it is obvious that the wires of adjacent strands will come into point contact with each other. This gives rise to the possibility of high stresses at these points of contact.

★ ★ ★

If we were to look at the cross-section of a 6 x 7 wire rope, it is conceivable that we might see two distinctly different geometric patterns depending upon the particular wire rope we had and where we were taking our cross-section. These two different geometric patterns are shown below in Figures 6(a) and 6(b).

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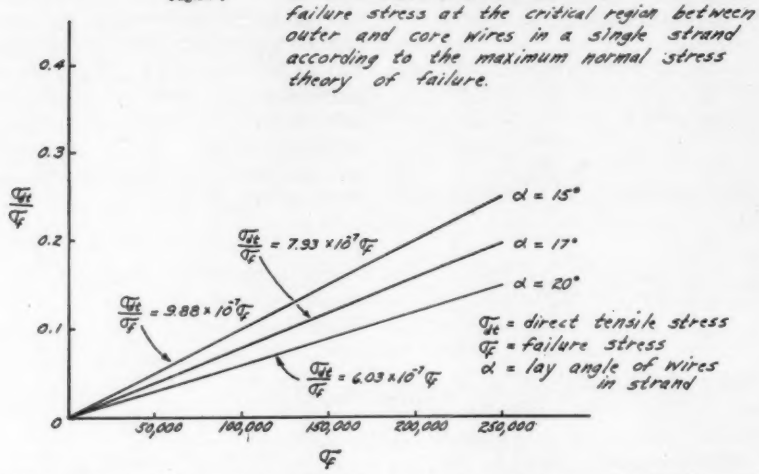
In Figure 6(a) it is seen that the adjacent strands contact each other at only one point, whereas

Figure 5 — The ratio of the direct tensile stress to the failure stress at failure vs. the failure stress at the critical region between outer and core wires in a single strand according to the maximum normal stress theory of failure.



in the pattern shown in Figure 6(b), the radial force of each strand is taken by two points. We may eliminate the condition of 6(b) as not being critical, since the force is taken by twice the number of points of contact.

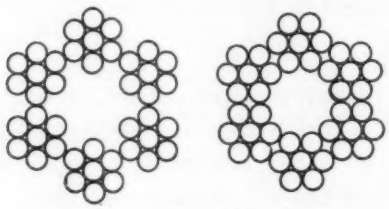


Figure 6

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At this stage, having determined the critical regions, we are ready to determine the forces acting at these places. Let us make the following definitions for this section of the work:

D = outside diameter of rope, in.
d = diameter of wire, in.
T = tensile force per strand, lb.
F_R = total radial force acting on a strand, lb per inch.
F_c = force between strands at points of contact, lb.
α = lay angle of wires in strand.
β = lay angle of strands in rope.
p = pitch between points of contact, in.

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The mean radius from the center of the rope to the center of the strands is seen to be D/3 in Figure 6(a). Therefore, using equation (4),

$$F_R = \frac{2\,T \sin^2 \beta}{D} . \quad (34)$$

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It can be seen that the pitch between consecutive points on one wire is π d/tan α. Therefore, the pitch p, between points of contact in the strand can be expressed by:

$$p = \frac{\pi d}{6 \tan \alpha} . \quad (35)$$

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At this point, the assumption will be made that the hemp core takes a negligible amount of the radial force of each strand. This is a justifiable assumption because the modulus of elasticity of the hemp core is much less than that of steel. In this case, from the geometry of the cross-section of the rope, the force perpendicular to the points of contact is equal to the force directed radially toward the center of the rope. The normal force per point of contact then is:

$$F_c = \frac{T (\sin^2 \beta) (\pi d)}{2 D (\tan \alpha)} . \quad (36)$$

★ ★ ★

For this type of rope, D = 9d, and equation (36) becomes:

$$F_c = \frac{T (\sin^2 \beta) (\pi d)}{18 d (\tan \alpha)} . \quad (37)$$

★ ★ ★

For most wire ropes of this type, β is approximately equal to α. Therefore, sin $\beta \approx$ sin α. Equation (37) becomes:

$$F_c = 0.1745\, T (\sin \alpha) (\cos \alpha) . \quad (38)$$

★ ★ ★

Knowing the force acting at each point of contact, it is now desirable to obtain design equations which relate the force applied to the stresses induced. The type of contact stresses present are similar to those discussed earlier for the critical regions between the core wire and the outer wires in a strand. However, for point contact, the contact area takes the form of an ellipse. The three principal stresses induced again are all compressive, however the method of evaluating them is much more complex. It is seen that the contacting wires of adjacent strands will cross each other at an angle 2α. This angle is comparatively large, and causes the problem to be different in nature than that of the preceding section.

★ ★ ★

Some very basic work on the subject of contact stresses has been done by Thomas and Hoersch[9]. They were able to present the relationships between the radial force and contact stresses for cylinders in point contact in a usable form. Nevertheless, the equations involved are quite complex. Elliptic integrals appear in several places, therefore, no explicit solutions can be obtained as were achieved in the previous section where line contact was involved. Because of the complexity of these relationships, the author will omit presenting them; however, the results of their application will be discussed.

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As for the preceding case, the maximum normal stress occurs at the surface and the maximum shearing stress at some distance below the surface of contact. The qualitative variation of the three principal shear stresses as a function of the depth below the surface is shown in Figure 7 for a lay angle of 21°. As before, σ_x, σ_y, and σ_z are the principal stresses in axial, tangential, and radial directions, respectively. It is seen that the $(\sigma_x - \sigma_z)$-component peaks at a significantly lower value than the $(\sigma_y - \sigma_z)$-component. A comparatively high value of direct tensile stress must be added to the $\sigma_x - \sigma_z$ shear stress to cause its value to exceed the $\sigma_y - \sigma_z$ shear stress. The value of the $\sigma_y - \sigma_z$ shear stress could be used if $\sigma_x - \sigma_z$ never exceeded it when the direct

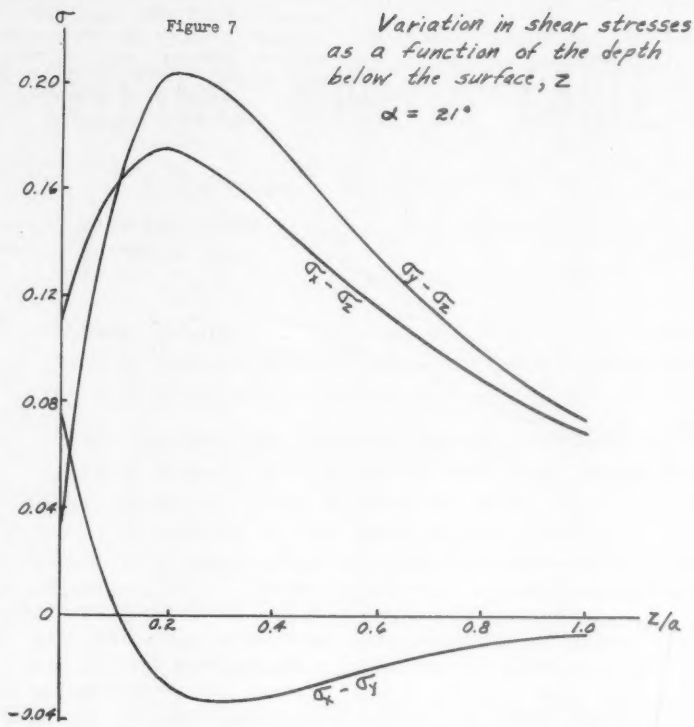

Figure 7 *Variation in shear stresses as a function of the depth below the surface, z*

$\alpha = 21°$

tensile stress is superimposed. From the results of the previous section, shown in Figure 4, it is seen that the direct tensile stress is a comparatively small portion of the total stress at failure. Furthermore, there is good reason to believe that the point contact of this section is far more serious than the line contact of the previous section. For these reasons, we can assume, for qualitative purposes of discussion, that the $\sigma_y - \sigma_z$ shear stress will never be exceeded.

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With the above assumption that the $\sigma_y - \sigma_z$ shearing stress is the largest, let us determine the magnitude of the contact stresses and, particularly, the ratio of the direct tensile stress to the actual stress at failure. If it is assumed that the material has a failure stress of 150,000 psi, as determined from a uniaxial test on a single wire, then $\sigma_y - \sigma_z = 150{,}000$ psi, and the maximum allowable shearing stress, t_{max}, is

$$t_{max} = (1/2)(\sigma_y - \sigma_z) = 75{,}000 \text{ psi}.$$

Furthermore, let the wire diameter be 0.05 inch (or a rope diameter of 0.45 in.), and let the lay angle, a, be 16°. Using the contact stress formulas, which have been omitted in this section of this paper, the radial force between strands, F_c, is found to be 0.306 lb. Using equation (38), the total tensile force causing this 150,000 psi failure stress is found to be only 6.6 lb! Finally, comparing the actual stress present with that direct tensile stress in the outer wires obtained from equations (1) and (3), the following ratio is found:

$$\frac{\sigma_{dt}}{\sigma_f} = 0.00328 .$$

That is, the actual stress present, using the maximum-shear-stress theory of failure, is approximately 300 times as great as that predicted by the elementary theory.

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Repeating this procedure, using the maximum - normal - stress theory of failure results in the even more astonishing ratio

$$\frac{\sigma_{dt}}{\sigma_f} = 0.000494 .$$

Thus, a more critical condition is predicted by the maximum-normal-stress theory than the maximum-shear-stress theory.

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Conclusions

In undertaking this work, the author was interested in attempting to contribute to the knowledge of stresses induced in wire ropes. Of particular interest was the condition at points of contact of individual wires in a wire rope, for it was felt that highly local stress concentrations existed at these points. The determination of the relative magnitudes of these stresses then became the goal of this work.

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Only the case of pure tensile loading was taken up, even though it is appreciated that bending a rope about a sheave may cause still more critical stresses, or the effects upon fatigue and corrosion properties may be even more significant. Nevertheless, the attempt was made to show that while these conditions may be critical, the high stresses at points of contact are in themselves quite significant.

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The analysis produced two critical regions, of which the first to be considered was the one between the core and outer wires in a single strand. Two failure theories were applied — the maximum-shear-stress theory and the maximum-normal-stress theory.

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The curves of Figure 4 actually show the significance of the tensile stress at this critical point. These curves represent the ratio of the direct tensile stress to the total stress in the rope at failure, plotted against failure stress. Thus, the ordinate represents the percentage of the total stress at failure which is due to the direct tensile stress. It is seen that for low strength ropes for which the yield point is near 50,000 psi, the tensile stress contributes only in the order of 10% of the total stress. However, for higher strength ropes such as those having a yield point of 200,000 psi, the tensile stress contributes more significantly to reach values as high as 30% of the total stress. Nevertheless, this is still a small portion of the total stress.

Perhaps an even more important concept to be obtained from these curves is that a much higher stress exists at these points than predicted by simple tensile-stress calculations. For example, if one had a wire rope of failure strength of 50,000 psi and lay angle 17°, the failure stress would actually be reached before one-tenth of the allowable load predicted by simple tension was applied. The curves also show that as the lay angle increases, the ratio of the direct tensile stress to the failure stress decreases. This is as one might expect since increasing the lay angle causes the radial force to increase which, in turn, causes the contact stresses to increase for any given load.

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The maximum - normal - stress theory of failure was then applied at the critical regions between the core and outer wires in a single strand. As it has been mentioned, these stresses are at a maximum at the surface. Also, for this case of line contact, it may be interesting to note that the stresses in the radial and tangential directions are equal to each other and larger than the axial stress.

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The results of this analysis are summarized by the curves shown in Figure 5. These curves represent the same functions as plotted in Figure 4 for the maximum-shear-stress theory of failure. It is seen that the ratio of the direct tensile stress to the failure stress varies linearly with the failure stress. Again, the values obtained show the important part played by the contact stresses in the stress picture.

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It is interesting to compare the values predicted by the two theories. In Figure 8, the curves of Figures 4 and 5 have been repeated for the value of lay angle of 17°. It is seen that the maximum-normal-stress theory predicts that the direct tensile stress is of less significance at failure than is shown by the maximum-shear-stress theory.

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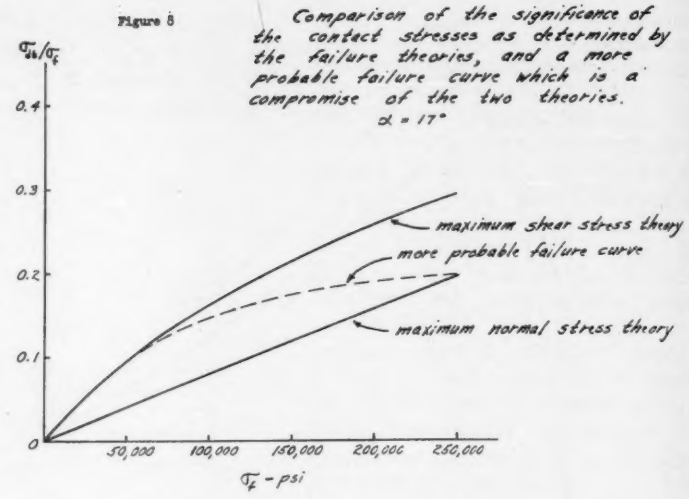
It has been found experimentally

Figure 8



that the maximum-normal-stress theory is fairly accurate in predicting the failure of brittle materials, while the maximum-shear-stress theory is applicable to ductile materials. What is meant by a ductile material and what is meant by a brittle material must be defined. There is no doubt that a steel with a yield point of 50,000 psi would be considered ductile. Similarly, the severe cold working necessary to give a steel wire of commonly used rope diameter a yield point of 250,000 psi would cause this material to be brittle. Thus, between these values of 50,000 psi and 250,000 spi, some condition exists which can only be defined as an intermediate degree of brittleness or ductility. Neither theory of failure applies accurately in this region. Therefore, a compromise must be assumed. On the curves of Figure 8, a broken line has been drawn between the value of 50,000 psi on the curve for the maximum-shear-stress theory and 250,000 psi on the curve for the maximum-normal-stress theory. Undoubtedly, a curve of this type represents the true ratio of the direct tensile stress to the failure stress as a function of the failure stress with better accuracy than either of the two theories. It is seen that the variation of the ratio is approximately between the limits of 0.1 and 0.2, with values very near 0.2 for the most commonly used rope strengths.

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The problem of analysis for the general case of crossed wires was very complex and a rigorous analysis was not attempted. Nevertheless, the method employed gave results of the type one might expect when compared with the results obtained for the case of line contact. To summarize the method employed, consider the curves of Figure 7. These curves indicate that the shear stress involving the axial and radial compressive stresses peaks at a significantly lower value than that of the tangential and radial stresses. The ratio of these peak values is approximately 17.6 to 20.4 or 0.86. Or if the direct tensile stress to be superimposed is 0.14 times the failure stress or less, its peak would never exceed that of the other shear stress. We have seen that the ratio of the direct tensile stress to the failure stress for the case of line contact results in values of about 0.1 to 0.3 for the maximum shear stress theory. We can assume that the point contact of this case is even more critical, and see what results are obtained.

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Since the stresses are a function of a number of variables, an example is selected for a commonly encountered size and strength of wire rope. The ratio of the direct tensile stress to the failure stress is found to be 0.00328 by the maximum shear stress theory and 0.000494 by the maximum normal stress theory. The extreme severity of the stresses at regions of point contact indicate that the

(*Please turn to page* 372)

ELECTRIC WIRE & CABLE SECTION NEWS

At its meeting on October 13, 1958, the Board of Directors of The Wire Association authorized the Section to hold a technical session in the Spring of 1959.

During the Annual Convention in Atlantic City, N. J., the Electric Wire and Cable Section Committee held a meeting at which Boston, Massachusetts, was decided upon as a desirable location for the meeting.

Urbain J. H. Malo, Technical Director, The Crescent Co., Pawtucket, R. I., was appointed Program Chairman, and the Statler Hotel, Boston, on April 29-30, 1959, has been decided upon as the time and place.

The Committee

The Men who comprise the Electric Wire and Cable Committee and who are responsible for the Association's service to this branch of our industry are:

Clement C. Lawson (Chairman)
Plant Facilities Engineer
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

Harold W. Adams, Prod. Supvr.
Cable Div. Reynolds Metals Co.
6601 W. Broad St.
Richmond, Va.

David Barr, Plant Eng.
National Electric Products Corp.
338 14th Street
Ambridge, Pa.

Grover W. Brown, Mgr., Machinery Development
The Okonite Co.
Passaic, N. J.

G. E. Forsberg, Vice-President
Surprenant Manufacturing Co.
172 Sterling St.
Clinton, Mass.

Charles M. Fredrickson, Tech. Dir.
Southern Electrical Corp.
P. O. Box 989, Chattanooga, Tenn.

James S. Higgins, Plant Eng.
Walker Brothers,
Copper Div.
Conshohocken, Pa.

R. W. Higginbottom, Chief Cable Eng.
Triangle Conduit & Cable Co.
P. O. Box 711
New Brunswick, N. J.

Alexander A. Kerr, Supt.—Prodn.
Electrical Wire Div.
John A. Roebling's Sons Corp.
Trenton 2, N. J.

C. L. Kessler, Chf. Works Met.
Aluminum Company of America
P.O. Box 150, Massena, N. Y.

Alfred H. MacGillivray, Supt.
Collyer Insulated Wire Co.
249 Roosevelt Ave.
Pawtucket, R. I.

Urbain J. H. Malo, Technical Dir.
The Crescent Co., Inc.
Front & Central Ave.
Pawtucket, R. I.

W. R. Moyers, Chief Eng.
Wire Engineering Dept.
Western Electric Co.
P. O. Station B
Buffalo 7, N. Y.

J. C. Murray, Jr., Vice-President
Crescent Insulated Wire & Cable Co.
319 N. Olden Ave.
Trenton 5, N. J.

D. M. Schmid, President
Techalloy Co., Inc.
Rahns, Pa.

Philip H. Snyder, Plant Mgr.
Wire and Cable Div.
The Electric Auto-Lite Co.
601 Poplar St.
Hazelton, Pa.

H. S. Spaulding, Tech. Supt.
Kaiser Aluminum & Chemical Corp.
P. O. Box 671, Newark, Ohio

Roger T. Stafford, Project Engineer
Kennecott Wire & Cable Co.
Phillipsdale (Rumford 16), R. I.

Marshall V. Yokelson, Res. Met.
General Cable Corp.
Bayonne, N. J.

Further details will be reported as they develop.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**

Handling, Storing and Shipping Reels of Cable

by Joseph Kelly
Planning Engineer, Cable Yards
Western Electric Company
Kearny, New Jersey

The first Kearny manufactured Exchange Area Cable was shipped during 1925 and in the following year the output reached a level of 12.4 BCF (billion conductor feet). The production level last year was 41.7 BCF over three times that of the first year's output. In the early years cable was wound on wooden reels and was protected by a layer of wooden lags nailed to the rims of the reel heads.[1] For the most part the reels were manually handled. After lagging the reels were rolled onto an elevator which lowered them to ground level. The reels were then manually rolled out of the elevator into a deposit area adjacent to the elevator entrance from where they were moved to a storage location using a battery powered locomotive crane and a two-man crew. The entire output during the first few years was handled with one locomotive crane and a second unit was added in 1928. The shipping was made by two media, rail or barge, and a locomotive crane was used to deliver reels from storage to the bulkhead for transfer to barge or to the three car platform at the south end of the storage yard.

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When the second locomotive crane was placed in service on the same track, it resulted in the creation of a bottleneck in utilization of these facilities that remained with us as long as the cranes were in use. There were times when the shipping schedules could not be maintained with the two locomotive cranes and additional crane equipment was obtained on a rental basis from the nearby Federal Shipbuilding Corporation, which at that time had surplus equipment available. (See Fig. 1)

1 The nailing of lags was eventually superseded by two steel straps holding these lags to the reels under pressure.

JOSEPH KELLY

This article describes the evolution of cable reel handling that has led to the present efficient methods currently in use by the author's company.

The author joined the company in 1933 and worked on factory planning until 1944. During this period he attended evening classes at the Newark College of Engineering, Columbia University and Pennsylvania State College. In 1946 he was appointed a materials handling engineer and in 1949 was moved into his present post. He is a member of the American Materials Handling Society.

The utilization of over the road trucks as carriers did not commence until a suitable platform for loading reels of cable was provided in 1930. This platform was accessible only by means of the locomotive cranes which deposited the reels there one at a time. The reels were then manually rolled into the truck. (See Fig. 2) About this time a great amount of operational difficulty was being experienced with the elevator which lowered reels from the cable plant floor elevation to the ground line so that action was taken to improve the delivery of cable from the cable plant to the storage area. As a result of this study, the elevator was removed and two ramps were installed from the first floor of the building to the ground line with aisles extending north and south to deposit areas at the ends of the yard to improve both delivery of cable from the plant and utilization of two cranes operating on a single track. This change required a new handling medium to replace the elevator and the material handling engineers developed a new type of electric powered industrial truck for this purpose. The front or load receiving end of these trucks were equipped with an apron plate and two hoisting winches with special grapples at the ends of two hoisting cables. The truck operator would approach the reel of cable to be transported so that the forward end of the apron slipped under the ledge of the reel heads.

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The truck operator would then dismount and engaging the grapples into the hub holes of the reels, he would then remount his truck and draw the reel up on the apron which was pivoted to tilt backward against the truck body for safety. (See Fig. 3) In addition, the front of the apron was equipped with a safety bar that would be drawn against the reel and locked in position to act as a block and hold the reel to the truck in event there was a failure in one or both of the steel ropes holding the reel on the truck.

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The introduction of the apron type electric powered industrial trucks brought about a new concept in handling and storing reels of cable as each truck would make the pick up of the cable reel at the lagging machine and then transport the reel across a scale for weighing and on to a deposit area, either at the north or south ends of the storage yard. As these deposit areas were filled up, a two-man team, consisting of a ground man and a crane operator, would remove the reels of cable to storage. This operation would involve

Fig. 1.

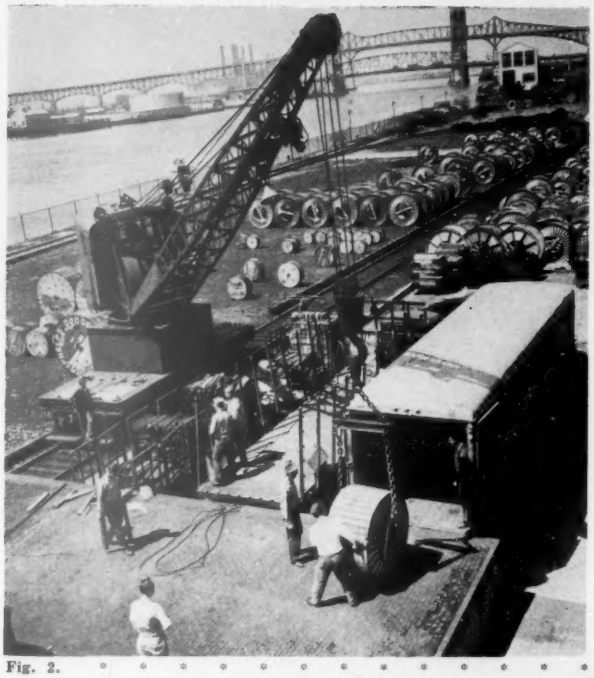

Fig. 2.

three men to transport a reel of cable from lagging machine to storage, one to transport the reel from lagging to the deposit area, one ground man to engage the crane grapple to the reel and one man on the crane to lift and transport the reel. The ground man would walk from the deposit area to storage where he would disengage the grapple from the reel. The entire plan required multi-handling to store the cable and in many instances resulted in lost reels due to the method of storage and selection. The crane operator, because of his position in the control cab, was designated to select the storage location since he had view of the entire yard. The reel location was recorded on the papers by the ground man who was responsible for this but he could easily make errors in noting the location as the reels were mass stored with little space between them. (See Fig. 4)

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Selecting cable from storage and delivering it to the shipping platform again involved multi-handling since the rail platform and the truck platform were separate locations. With both cranes operating on a single track, it was found that the cranes were in frequent conflict with each other in making deliveries of cable to the proper shipping platform. (See Fig. 5) In addition, we could not obtain maximum efficiency of the equipment for either normal or emergency shipments of cable due to this conflict in competition between cranes to making deliveries to the same location.

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About eight years ago, one of the two locomotive cranes was overhauled at a cost of $25,000, which was approximately ¼ the cost of a new crane. The maintenance organization was requested to make a detailed check on the costs of keeping both the equipment and trackage in proper operating condition. In about three years it was found that the second locomotive crane also required major overhaul to continue it operating. The question was then raised as to whether we should (a) make the major repairs, (b) replace the cranes or (c) introduce a new method of handling and storing cable. Estimates were made on the necessary

Fig. 3.

Fig. 4.

Fig. 5.

repairs and in turn the problem was reviewed by a consultant from a competent locomotive repair company. It was found that the locomotive crane repair costs would be approximately $50,000 and there would still be no guarantee of continued operation without need for further repairs within a few years. In addition, it was found that we would require expenditures of $100,000 annually to maintain the cranes, yard, trackage, third rail, power distribution and trucks. With the above background it was decided to make detailed investigation of other possible plans for action and make recommendations for the most advantageous plan, both from the economic and handling viewpoint. The following steps in the investigation led to the complete replanning of the storage and handling system.

A. Production

The engineers contacted the Sales Organization and the Comptrollers office to ascertain the future of cable production and it was found that long range forecast indicated a continued ratio in excess of 25 billion conductor feet for a number of years, with excess beyond the 30 BCF level in some years. The quantity of reels required to meet these levels were more difficult to ascertain as there were many factors, such as pair size and cable length that could change the requirements very substantially. After resolving this condition we agreed to use 40,000 reels for a production level of 30 BCF and we determined our requirements for handling facilities. This, of course, did not close the door as to future requirements.

B. Inventory

An accurate figure for inventory was difficult to determine but quantities of reels for production level and past experience indicated that two to three weeks' stock was sufficient, and it was decided to provide space for 2000 reels, which was equivalent to 2.5 weeks' production. The layout was made flexible so as to permit stocking up of 2,600 reels if abnormal conditions arose that were beyond production control. Some of the factors considered were strikes in the shipping industries.

C. Various Plans Considered

A number of plans were investigated and then each plan was compared with the present system, including overhauling costs, to see which was the most advantageous one to recommend to our management. The plans, considered with their cost and savings, are listed below:

Plan		Cost	Annual Savings	How Accomplished	% Invest. Ret. In 1st Year (Before Taxes)
1	Major repairs to present equipment	A (Base Cost)	0	—	0
2	New Locomotive crane	A + $150,000	0	—	0
3	New Locomotive crane with automatic grapples	A + $180,000	$15,000	Eliminate Ground man	6½
4	Bridge Cranes and Runways	A + $250,000	$10,000	Elim. Ground man Lower Maint.	3½
5	Paved storage yard with racks to store reels 3 high	A + $230,000	$45,000	Elim. Crane Crew Substitute Less Costly Equipment	16
6	Paved yard to store a minimum of 2000 reels on ground level; purchase industrial trucks	A + $100,000	$50,000		

The above comparison indicated that Plan 6 would result in the most satisfactory solution to our problem, as it provided flexibility, mobility, and cost reduction savings. A formal request was then prepared and forwarded to the Board of Directors to authorize capital expenditures to proceed with Plan 6 and this was granted early in 1953.

D. Installation

Before any installation was made a number of steps were taken to insure obtaining the best possible return from the construction dollar. It was found that it was not economically possible to construct a combined rail and trucking platform, as the marshy sub-soil under the reel yard made it necessary to install piling to support such a structure. We then decided to maintain the present rail platform without any change, but to increase the capacity of the truck platform and install new ramps for access between the ground level, truck shipping platform and cable plant floor. The amount of paving provided was sufficient to receive 2000 reels of cable with every reel directly accessible using a ram type industrial truck. The main aisle running north and south was 20′-0″ wide to permit ease of movement of two-way traffic and the side or storage aisles were 14′-0″ wide, which was sufficient to permit right angle stacking. The concrete floor or pavement was of 8″ reinforced concrete laid in 12′ strips, with all sections dowelled to each other with steel pins to prevent misalignment in event there was settlement under the pavement.

E. Industrial Trucks

Various types of industrial trucks were investigated and considered including conventional fork type, side loading commercially available and special design and apron type, both fixed and swivel type platform, in order to minimize space requirements. The equipment finally adopted provided ram type trucks (Fig. 6) to permit handling through the drum of the reel, as we found this to be the most flexible and economical unit available. The other types were discarded either from the cost factor, damage possibility as with conventional forks or due to uneconomical utilization of space. We have not closed our investigation

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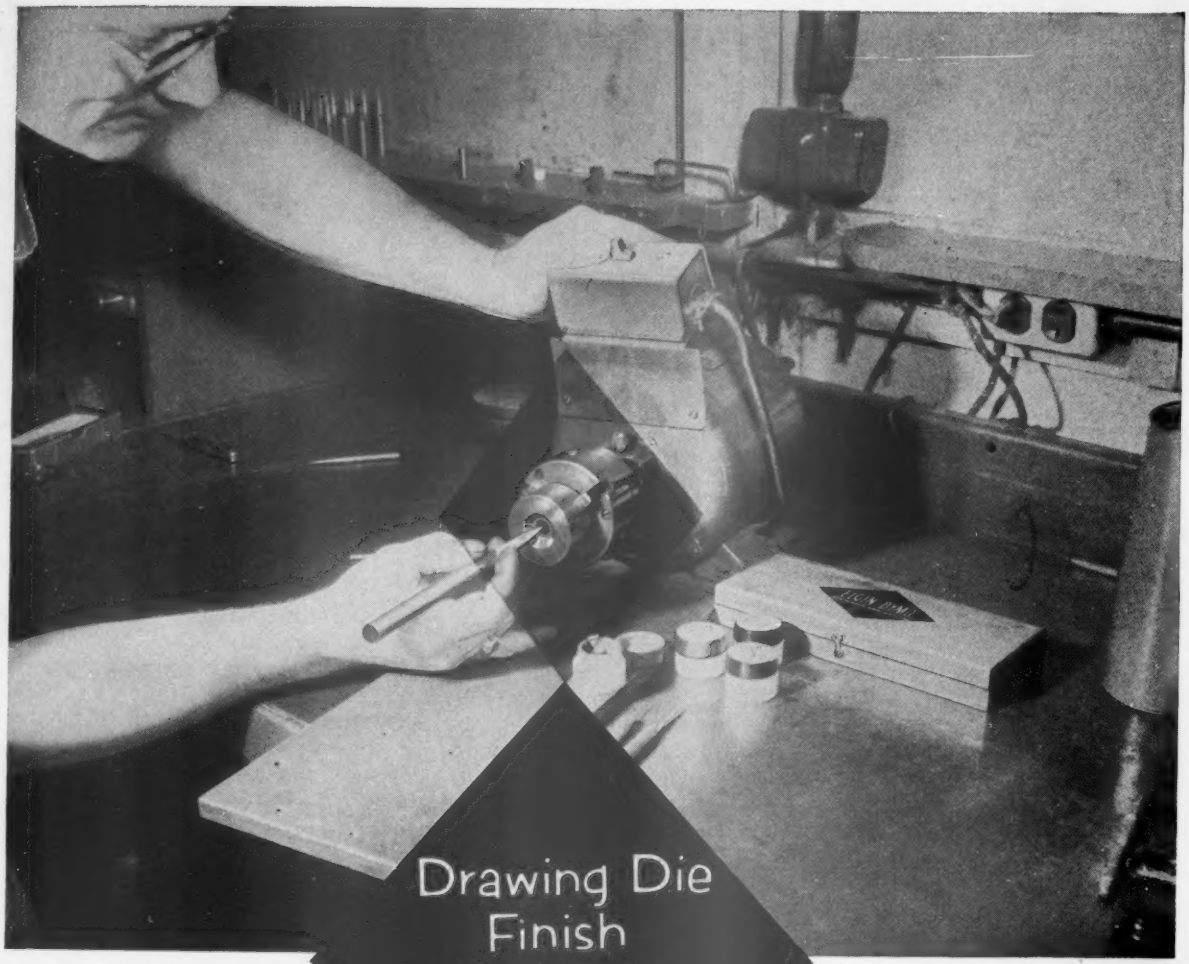

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Flame Retardant Polyethylene for Wire and Cable

by

R. C. Graham
Chief Engineer
Rome Cable Corporation
Rome, New York

and

C. A. Neros
Director of Laboratory
Diamand Alkali Company
Painesville, Ohio

This paper was presented at the Seventh Annual Symposium on Technical Progress in Communication Wires and Cables, sponsored by the U. S. Army Signal Research and Development Laboratories, on December 2, 1958, at Asbury Park, N. J.

With the introduction of polyethylene over fifteen years ago, it was commonly explained that while this material was the best electrical insulator yet developed for wire and cable, it looked, smelled, and even burned like a candle. This exaggeration is partly true, and several investigators have since devised various ways and means to impart a certain degree of flame resistance to the material. Most of these approaches towards flame retardancy have usually resulted in a considerable sacrifice of other inherently desirable characteristics of polyethylene, either physical and electrical, or both. Therefore, about nine years ago (1949) the research divisions of the Diamond Alkali Company in collaboration with the Rome Cable Corporation undertook the development of flame retardant polyethylene formulations that would maintain a maximum of original polyethylene characteristics—especially those properties having a particular significance for insulation or jacket on wire and cable. The first requisite, therefore, was to retain to a maximum degree the desirable characteristics of polyethylene.

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Early in this development program it was determined that these objectives might be possible if a so-called "adequate" or a moderate degree of flame resistance was acceptable. The acceptable degree of flame resistance was determined by two tests. The first test involved the use of moulded slabs or sheets of the material to meet the requirements of flammability as outlined in ASTM D-635-44. The second test involved the use of extruded wire coatings to meet the horizontal Underwriters' Laboratories flame test as required on all types of rubber insulated building wires. This measures the ability to prevent or limit flame travel. For sake of brevity these tests procedures will not be described here, but can be found in the appropriate references as noted above.

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The original electrical characteristics of polyethylene should preferably not be affected beyond the ability of the material to serve as a satisfactory insulator in the power and audio frequency spectrum with minimum reduction in original and aged physical properties, moisture resistance, weathering, low temperature characteristics, and resistance to thermal or environmental stress cracking. An obvious objective was that the inherent material cost and processing problems in wire coating must not be substantially increased. This paper records how and to what extent these objectives were achieved.

Historical

During the years of World War II, several concerns were actively engaged in the production of chlorinated paraffins. These products were first supplied as a viscous liquid containing 40-42% chlorine and later as a white solid which contained 70-72% chlorine. These materials were consumed primarily in the preparation of flame retardant canvas duck for the Armed Forces. At the close of the war in 1945, the demand for chlorinated paraffin virtually disappeared and consequently the producers of chlorinated paraffin were pressed to find new uses for these products in order to keep their plants in operation.

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Since a flame retardant additive composition consisting of a mixture of chlorinated paraffin and antimony trioxide appeared to be most effective for preparing flame retardant textiles (1), this combination was investigated for use in making a variety of plastic materials flame retardant (2, 3). One of the most interesting applications appeared to be in the production of flame retardant polyethylene for use in wire coatings (4, 5, 6). Accordingly, a considerable amount of work has been done to develop a satisfactory flame retardant electrical insulation for wire coating.

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A satisfactory performance record of several years has been obtained on various wire and cable applications involving these coatings. These include 600 volt rated power distribution circuits wherein the insulation and sheath were formed from a single extrusion, control and signal cable utilizing the material as primary dielectric and similar cables wherein the individually rubber or thermoplastic insulated conductors were jacketed with flame retardant

polyethylene. Greatest experience has been obtained on several thousands of feet of power and control cable wherein the overall jacket has been flame retardant polyethylene — regardless of the type or dimensions of the underlying insulated core.

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In all of these wire and cable applications it was found desirable and almost mandatory to incorporate a small percentage of butyl rubber (GRI) in the polyethylene compound to retain the desired specified initial and aged elongation properties together with the required low temperature performance. The addition of butyl provided increased resistance to stress cracking without harmful effects on cost, extrusion, moisture resistance, electrical characteristics and flame retardancy.

Flammability of Flame Retardant Polyethylene Compositions

In order to characterize the general flammability characteristics of flame retardant polyethylene, the test method described under ASTM D635-44 was used to evaluate a series of flame retardant compositions in sheet form.

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Various ratios of Chlorowax 70* (Chlorinated Paraffin) to antimony trioxide were investigated at loadings based upon the compound weight of 5, 10, 20, 30, 35, 40, and 50%. The ratios of chlorinated paraffin to antimony trioxide were 10/90, 20/80, 30/70, 40/60, 70/30, 80/20, and 90/10. In addition to these materials, Akroflex C (0.2% of polyethylene) and Tribase E (5% of chlorinated paraffin) were added as stabilizers for the polyethylene and chlorinated paraffin respectively.

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A typical formulation at a 30% loading and a 50/50 ratio of chlorinated paraffin to antimony trioxide could be represented as follows:

Polyethylene	—	70.0 parts
Chlorowax 70	—	15.0 parts
Antimony Trioxide	—	15.0 parts
Tribase E	—	0.75 parts
Akroflex C	—	0.14 parts

* Chlorowax 70 is the Registered Trademark of Diamond Alkali Company.

The formulations were blended on a two-roll mill and compression moulded to give sheets 0.075 inches thick.

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A summary of the data obtained on flammability is shown in Figure 1.

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An attempt was also made to observe the tendency of the composition to drip during the flame test since this characteristic is of some importance in wire coatings and these observations are likewise indicated in Figure 1.

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Although there is some variation in the flammability data obtained by this method, it can be seen that in general the useful compositions will be found in the region ABC. At the lower loadings of 10-30% a range of compositions was found to be self-extinguishing, but which showed a degree of dripping. In the figure this range of compositions is represented by the area DBE. For compositions that are self-extinguishing and that will not drip, one must have a loading of about 32% or greater and the range of compositions having these characteristics is indicated approximately by ADEC.

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The figure also shows that between loadings of 30-40% better drip and flame resistance is obtained at the higher ratios of chlorinated paraffin to antimony trioxide.

In general, these results indicate that the flammability characteristics and the drip resistance become better as the degree of loading is increased; also, the more useful compositions approximate 1 to 1 and greater ratios of chlorinated paraffin to antimony trioxide.

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In evaluating the flame resistance of materials used as wire coatings, there are two general methods available; these are known as horizontal (7, 8, 9) and the vertical (8, 10, 11) test methods.

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The horizontal test method (7) was used to evaluate the flame resistance of a series of compositions coated on #12 solid wire with a wall thickness of 1/32 inch. The ratio of chlorinated paraffin to antimony trioxide was varied while the degree of loading based upon the compound weight was maintained at 32%.

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A summary of the compositions studied is shown in Table 1. Antioxidants were, of course, equally incorporated in each compound. The results obtained for flame resistance are presented in Tables (2) and (3). These results indicate that polyethylene not compounded for a degree of flame retardancy fails by a wide margin the flammability requirements of either the Underwriters' horizontal or vertical flame test. The data also indicates that compositions

TABLE 1
Composition of Flame Retardant Polyethylene Compounds

	1	2	3	4	5	6	7	8
Polyethylene	62.7	62.7	62.7	62.7	62.7	62.7	66.0	100.0
Butyl GRI-035	3.3	3.3	3.3	3.3	3.3	3.3	—	—
Antimony Trioxide	32.0	25.6	19.2	12.8	6.4	—	19.2	—
Chlorowax 70	—	6.4	12.8	19.2	25.6	32.0	12.8	—

TABLE 2
Horizontal Flame Test (Underwriters')
One 30 second flame application.
Sample length 11 inches.

	Burning Time Sample			Total Propagation Sample		
Formulation	#1	#2	#3	#1	#2	#3
#1	19 Secs.	16 Secs.	—	1¾"	1¾"	—
#2	4 Secs.	8 Secs.	—	2"	2 1/16"	—
#3	2 Secs.	11 Secs.	17 Secs.	2"	2 9/16"	2 5/16"
#4	2 Secs.	2 Secs.	—	2"	1⅞"	—
#5	3 Secs.	2 Secs.	—	1 15/16"	1 15/16"	—
#6	6 Secs.	7 Secs.	—	2¼"	2¼"	—
#7	3 Secs.	2 Secs.	—	2"	2"	—
#8	2½ Mins.	2½ Mins.	—	11"	11"	—

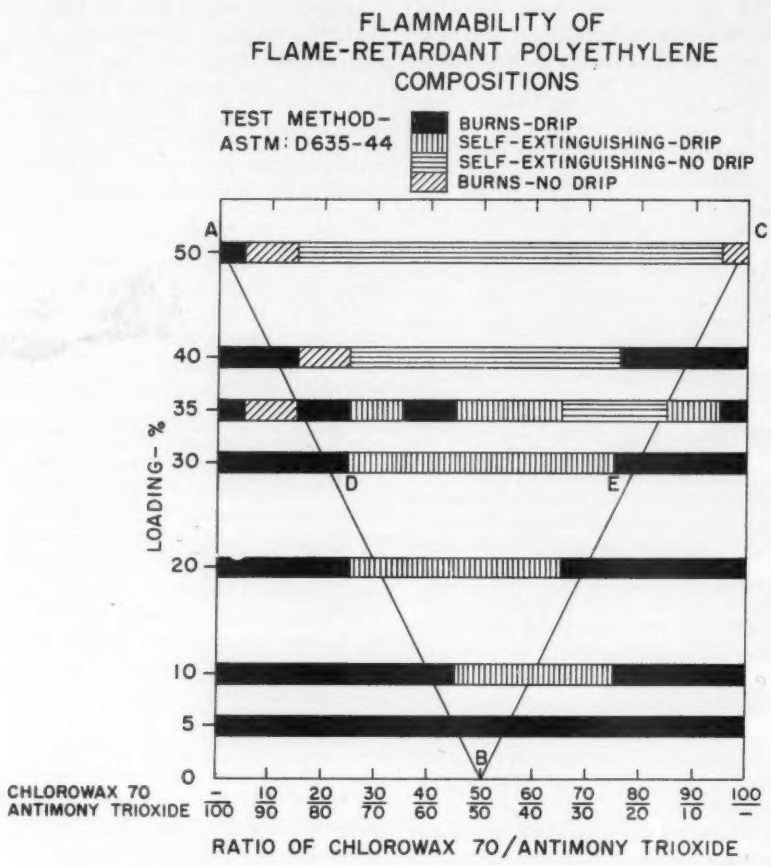


TABLE 3

Vertical Flame Test (Underwriters')
Five 15 Second Flame Applications

Formulation	Result (3 Samples Each Composition)
#1	Fail
#2	Fail
#3	Pass
#4	Pass
#5	Pass
#6	Fail
#7	Pass
#8	Fail

Note: Burning of the paper flag which is attached at top of sample, constitutes a failure.

with and without butyl rubber additive (compositions 7 and 3) meet both test requirements. A further observation can be made that compositions containing chlorinated paraffin without antimony trioxide and vice-versa (composition 6 and 1) also fail to meet the flammability test limits.

Physical and Electrical Test Data

Unless otherwise indicated the remaining test data was obtained on wire coatings (Size 14 AWG solid 1/32" insulation thickness). The flame retardant polyethylene compound was based upon a formulation containing 32 percent loading with an equal ratio of chlorinated paraffin to antimony trioxide. Using this as a base compound tests were conducted using different types and grades of polyethylene with and without approximately 3.5 per cent butyl rubber content. Loadings up to 36 percent exhibited some further improvement in flame resistance without appreciable change on physical or electrical properties herein reported. However, with further substantially higher loadings the stability of the desirable characteristics of flame retardant polyethylene composition is decreased.

Effect of Butyl Rubber on Physical Properties

The data in Table 4 were recorded before and after air oven aging at 100°C for extended periods.

* * *

The accelerated aging data in Table 5 were obtained on samples of flame retardant polyethylene **jacket** compound (removed from cable) incorporating high molecular weight polyethylene and a small percentage of butyl rubber.

Effect of Molecular Weight on Physical Properties of Flame Retardant Compounds

Figure 2 illustrates that increased values of original and aged physical characteristics may be realized by incorporating high molecular weight instead of conventional molecular weight polyethylene. These compounds contained

TABLE 4

Aged Physical Data on Flame Retardant
Polyethylene Insulation Compositions at 100°C

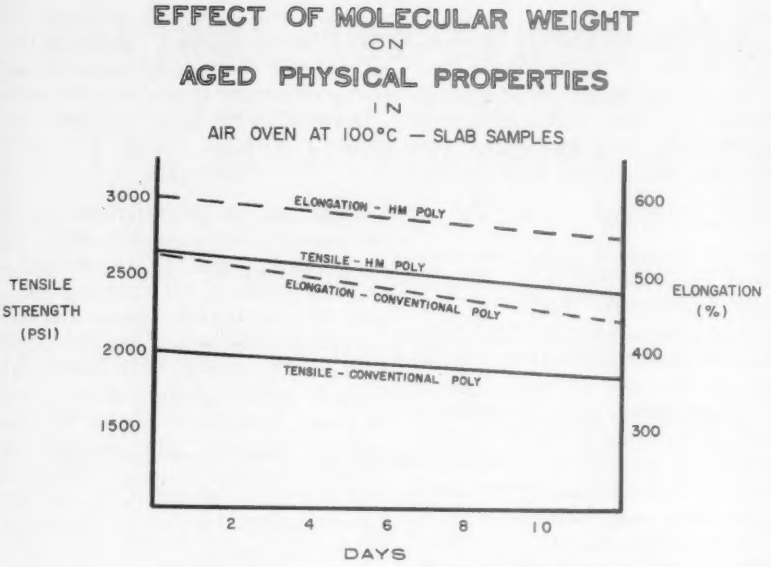
	Original	1 day	3 days	7 days	30 days
Tensile Strength (psi)					
Without Butyl	1600	No appreciable reduction			
With Butyl	1600	No appreciable reduction			
*Higher loading without Butyl	1800	No appreciable reduction			
Elongation (percent)					
Without Butyl	430	75	50	25	25
With Butyl	550	500	400	300	200
*Higher loading without Butyl	85	25	12	12	12

*Note: This refers to a commercially available flame retardant polyethylene compound with substantially higher loadings.

TABLE 5

Aged Physical Data on Flame Retardant
Polyethylene Jacket Compound at 100°C

Aged Time (days)	Tensile (psi)	Elongation (percent)
Original Physical Properties	1990	575
2	1850	525
5	1775	550
7	1830	517
14	1825	550



the identical butyl additive.

Low Temperature Properties

The following brittle point temperatures (ASTM 746-55T) were observed on flame retardant compounds with and without butyl rubber:

Without Butyl	—20°C
With Butyl	—40°C
A substantially higher loaded Commercial Grade	—20°C

Stress Cracking Characteristics

The following tests were conducted in accordance with the method described in the Appendix specification which is substantially similar to the method developed by DeCoste, Malm and Wallader (11) of Bell Telephone Laboratories Inc.

Composition	Failures	Time to First Failure	*Total Test Time of Non-Failing Samples
Flame retardant polyethylene (with butyl)	None	—	1200 hours
High molecular weight polyethylene with 5% butyl	1	159 hours	1200 hours
Conventional polyethylene with 5% butyl	3	39 hours	1200 hours
Conventional polyethylene (no butyl)	4	5 hours	—

* Note: Test discontinued after 1200 hours.

Electrical Characteristics

The following Table 6 summarizes various electrical parameters as measured on samples of flame retardant polyethylene with and without butyl as compared with conventional polyethylene.

In long time accelerated electrical moisture absorption tests extending up to 5 years in water baths maintained at 50°C and 70°C all flame retardant compounds exhibited completely stable characteristics equivalent to conventional polyethylene. A rather significant and yet unexplainable result was obtained on electro-osmosis tests wherein the insulated wire (Size 14 AWG solid 1/32") test specimens were permanently energized with 600 volts d-c with both negative and positive polarity. After two years immersion at 70°C some water line failures were obtained on conventional polyethylene, but no failures of any type were obtained on the flame retardant polyethylene (incorporating butyl rubber) insulated conductors.

Processing Notes

Conventional methods are followed in compounding and mixing. Equally successful results may be obtained by masterbatching the Butyl Rubber with the Polyethylene or by adding the rubber directly to the batch along with the other ingredients. Mixing is accomplished in a Banbury mixer. All ingredients are added at the start of

TABLE 6
Measured Electrical Characteristics—Typical Values

	Flame Retardant Polyethylenes			
	Conventional Polyethylene Without Butyl	H. M. Polyethylene Without Butyl	H. M. Polyethylene With Butyl	Non-Flame Retardant Conventional Polyethylene
1000 Cycle (70°C) Power Factor, %	0.6	0.8	0.7	0.05
1000 Cycle (70°C) S.I.C.	2.7	2.7	2.7	2.3
60 Cycle (70°C) Power Factor, %	1.0	1.0	0.7	0.07
60 Cycle (70°C) S.I.C.	2.7	2.7	2.7	2.5
Dielectric Strength (volts per mil) 60 Cycles—500 volt/sec. rise	1150	1300	1200	1200
Insulation Resistance Megohm 1000 ft. After 24 Months in Water at 70°C	10000	12000	8000	10000
Surface Resistivity		Too High to Measure		
80 volts per Mil Power Factor 20°C	—	—	0.29	—
40°C	—	—	0.47	—
60°C	—	—	0.67	—
80°C	—	—	0.86	—
90°C	—	—	0.71	—

the mixing cycle and are masticated at low speed for approximately four minutes. The mixing is then continued at high speed, mixing until a homogeneous blend is obtained. The batch is then sheeted on hot rolls from which it is passed through a cube cutter and cut into cubes of the desired size.

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Extrusion may be accomplished on any size conventional type wire extruder with extrusion practices similar to those used for Polyethylene. Experience has shown that 400°F is an ideal stock temperature for the compound at the die. A Polyethylene type screw should be used and a screen pack consisting of 2 X 40 and 2 X 80 mesh is adequate. Conventional Polyethylene dies are used. As with other thermoplastic materials, it is advantageous to employ heated conductors for optimum physical and aging properties when used as an insulation.

Specifications and Ratings

Insofar as installation and operating temperatures are concerned it is suggested that the same limitations applicable to the grade and type of polyethylene used in the flame retardant mixture be observed since the effect of the flame retardant additives with a small amount of butyl rubber does not appreciably change performance at the temperature extremes as illustrated by the aging data and cold temperature tests. This point at the higher temperature is further amplified by a comparison of the following heat deformation values measured in accordance with ASTM D-734 procedure (500 gram load) except that a temperature of 100°C was used instead of 121°C.

ASTM D-734 Deformation Tests (100°C) on Polyethylene Compositions

Flame retardant polyethylene (H.M. polyethylene—no butyl)	0.62%
Flame retardant polyethylene (H.M. polyethylene—with butyl)	1.17%
Conventional polyethylene (not H.M.)	2.34%
Conventional polyvinyl chloride (TW)	18.00%

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Until further operating experience has been obtained, particularly with various colored insulation, it is recommended that for power cable insulation the flame retardant polyethylenes as described herein be temporarily limited to a maximum rated circuit potential of 5000 volts, although the previous electrical data indicate that this may well be increased.

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One of the most important uses of this material will be as a cable jacket or sheath. Based upon a compound incorporating high molecular weight polyethylene with a small percentage of butyl rubber the performance specification described in the Appendix is recommended. It should be noted that except for the addition of the horizontal flame test that this specification is identical to that established by IPCEA for black polyethylene jackets.

Effects of Density

A limited investigation has been conducted on making high density or linear polyethylene flame retardant. Flame test results were, if anything, an improvement over the lower density polyethylene compounds probably due to the inherently higher softening temperature and improved deformation characteristics of high density polyethylene. The addition of butyl rubber was practicable and produced the same beneficial results as obtained with the flame retardant lower density compounds. The data in Table 7 indicate the aging and flame test data using flame retardant linear polyethylene compound with butyl rubber additive.

TABLE 7

Accelerating Aging Data on a Flame Retardant Linear Polyethylene Composition at 100°C

Sample: #14 AWG solid, 1/32" insulation

Aged Time (days)	Tensile (psi)	Elongation (percent)
Original Physical Properties	3505	738
3	2635	812
5	3145	800
7	3280	800

Horizontal Flame Test

Sample	Time of Burning	Propagation
1	1.0 seconds	2.0 inches
2	1.0 seconds	2.25 inches
3	1.0 seconds	2.25 inches

Vertical Flame Test (Five 15 second applications)

All Samples (3) Passed.

Summary

Loadings on polyethylene up to 36 percent with proper ratios of chlorinated paraffin to antimony trioxide produce wire coating compounds meeting the desired levels of flame retardancy as described herein. The use of high molecular weight polyethylene improves physical characteristics of the resultant mixture. The addition of small quantities of butyl rubber to the extent of about 5.0% on the polyethylene, further improves properties so that the final compound more closely exhibits the original performance characteristics of the polyethylene resin. These compositions have been found to produce satisfactory insulation and jacket compounds.

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The future for this procedure in obtaining flame retardant properties holds considerable promise for other polyethylenes, such as the linear and possibly cross-linked varieties as well as for other polyolefins.

Bibliography

1. Edwin C. Clayton and Lawrence L. Heffner, "Fire Composition and Fabric," U.S. 2,299,612.
2. George F. Rugar, "Flameproof Thermoplastic Molding Compositions," U.S. 2,590,211.
3. Lester A. Bierly, "Flame-Resistant Compositions," U.S. 2,669,521.

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COMING — THE SPRING REGIONAL MEETING

of

THE ELECTRIC WIRE & CABLE SECTION

THE WIRE ASSOCIATION

A Good Meeting for all Men Concerned with Production

THE TIME: April 29-30, 1959 THE PLACE: Statler Hotel, Boston, Mass.

THE PROGRAM

Wednesday Morning, April 29

9:00 A.M.—Registration—Members, Guests, and Ladies.

10:00 A.M.—Electric Wire & Cable Section Committee Meeting.

10-11 A.M.—Ladies' "Get Acquainted" Coffee Break.

12:15 P.M.—Committee Luncheon for Program Participants.

Wednesday Afternoon and Evening, April 29 — *Program of Activities:*

1:00 P.M.—Ladies Tour of Historical Boston.

1:45 P.M.—Address of Welcome by Allan B. Dove, Association President.

2:00 P.M.—Technical Session.

MODERATOR: JAMES E. FLOOD, Technical Director, Plastic Wire & Cable Corp., Jewett City, Conn.

PAPERS: "Induction Heating System for Thermoplastic Extrusion" by GEORGE E. CARLE, Div. Eng.-Extruding, Farrel-Birmingham Co., Ansonia, Conn.

"Wire Handling Systems" by PHILIP C. GREENE, Sales Manager, Davis-Standard Div., Franklin Research Corp., Mystic, Conn.

"Common Extrusion Problems and Their Solution" by JOHN L. YOUNG, Technical Service, Plastics Div., Monsanto Chemical Co., Springfield, Mass.

"Processing of Cross-Linked Polyethylene" by ARTHUR C. ROWLEY, Sales Representative, R. T. Vanderbilt Co., New York, N. Y.

6:00 P.M.—Hospitality Hour preceding dinner as guests of several concerns.

7:00 P.M.—Dinner, followed by after-dinner speaker of national reputation. Ladies are invited to the Hospitality Hour and Dinner.

Thursday Morning and Afternoon, April 30 — *Program of Activities:*

9:00 A.M.—Technical Session.

MODERATOR: THOMAS K. COX, Eng.—Rubber & Plastic Covered Wire, Western Electric Co., Baltimore, Md.

PAPERS: "Controlled Cooling of Extruded Polyethylene Insulations" by MICHAEL M. SUBA, Manager, Extrusion Materials, Union Carbide Plastics Co., New York, N. Y.

"Continuous Annealing, Preheating and Insulating of Electrical Conductors" by BROOK W. LERCH, Engineer—Rubber & Plastic Insulating, Western Electric Co., Baltimore, Md.

"Quality Control in Processing of Submarine Cable" by W. M. FLEMING, JR., Quality Control Supt., Submarine Cable Div., Simplex Wire & Cable Co., Newington, N. H.

"Electric Wire Quality Control" by WILLIAM M. LAND, Chief Chemical Engineer, Surprenant Manufacturing Co., Clinton, Mass.—A discussion plus a motion picture.

1:00 P.M.—Visit to SIMPLEX WIRE & CABLE COMPANY's plant in Cambridge, Mass.

Be sure to attend this important meeting. Association members will receive hotel reservation cards by mail. Others desiring to attend may write for them. All electric wire and cable men are cordially invited.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**

New Kingfield Rod and Wire Works

by Special Correspondent
England

A brand new company and all-new equipment has added to England's wire capacity, covering which is a brief description of its facilities.

The Darwins Group formed a new firm in 1957, **Darwins Bright Steels Ltd.,** to produce bright steel bars and wire. A new mill was built at Sheffield, England, and opened in June, 1958. The new rod and wire mill consists of five bays. Each is 112 feet long and 45 feet wide and the total floor area is 28,000 sq. ft. No. 1 bay is used for heat treatment. Plant installed includes a 350 KW steel spheroidizing furnace, equipped with automatic 3-zone control. (Fig. 1) A pit type furnace with 3 pots and three pit type vertical furnaces are also in operation. (Fig. 2).

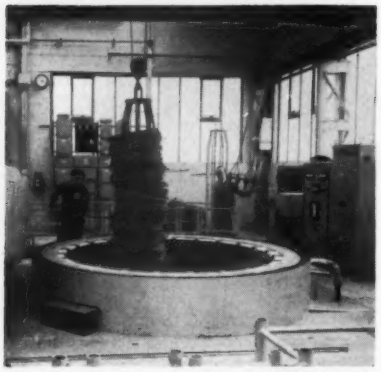

Fig. 1—Charging spheroidizing furnace.

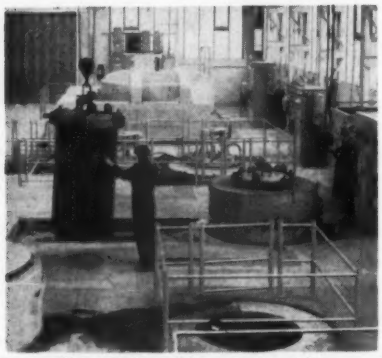

Fig. 2—General view of heat-treatment bay.

The equipment in bay No. 2 is used for the cleaning and de-scaling of wire and wire coils after treatment. It includes two descaling plants. One is electrically heated using sodium-hydride at 350°C working temperature. The other is a gas-heated Efco-Virgo descaling bath. The water quenching tank is fully screened. It has double doors which are pneumatically operated. Seven brick tanks are used for acid pickling, hot water bath, water spray and lime dipping. The wire coils emerging from the last tank are heated in an electric baking furnace (200° to 300°C. working temperature).

Wire Drawing Section

The main equipment comprises a Farmer-Norton 9 Hole Wire Drawing Machine capable of drawing wire .082" diameter down to .042 dia. in 9 passes or ranges between these sizes and down to .018". (Fig. 3) Another Farmer-Norton 4 Hole Wire Drawing Machine is capable of drawng from a maximum starting size of .212" dia. to a finished size of .012" dia. A 26" Hot Wire Drawing Block is installed with infinitely variable speed between 50 to 200 feet per minute. High speed steel wire is heated through a graphite bath, baking oven and lead bath furnace. The sizes range between .330" dia. to .035" dia.

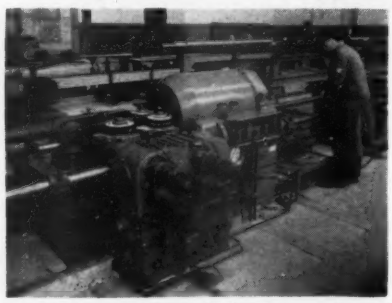

Fig. 3—Farmer Norton cold drawing machine.

Eight single Wire Drawing Blocks are available, 2 - 22" dia., 3 - 18" dia., 3 - 12" dia. The blocks are capable of drawing wire up to .550" dia. with the lowest finishing size of .018" dia. (Fig. 4).

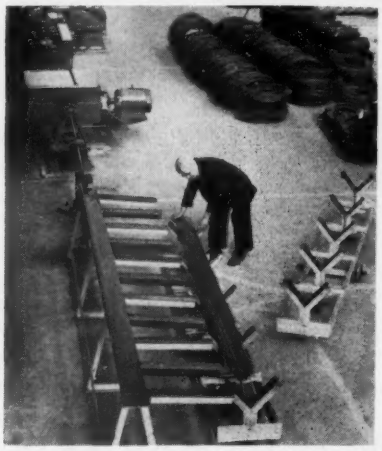

Fig. 4—Schumag combined drawing and straightening machine.

In the No. 4 bay is located one Crossley 8 Block Wire Drawing Machine. A Schumag combined Drawing Machine for drawing, cutting, straightening and polishing deals with rounds, as well as for drawing, cutting and straightening of squares and hexagons, adapted for steel and iron. The range of this German built machine is as follows: Rounds—.158" to .512" dia.; Squares — .158" to .472" across flats; Hexagon—.196" to .512" across flats. Bar length is 2 to 4 metres. The drawing speed is 40 metres per minute with maximum pull 3000 kilograms.

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Space does not allow a detailed description of the Schumag machine, but very satisfactory operation is reported.

Finishing and Dispatch Sections

The No. 5 bay includes a number of auxiliary machines.

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Three Straightening and Cutting Off Machines which are capable of handling materials from .400" di-

(*Please turn to page* 373)

Alumoweld—A New Bimetallic Wire for Electrical and Strength Applications

by F. E. Leib, Manager of Sales
Copperweld Steel Company
Glassport, Pennsylvania

This paper was presented on December 2, 1958, at the Seventh Annual Symposium on Technical Progress in Communication Wires and Cables at Asbury Park, N. J., under the auspices of the U. S. Army Signal Research and Development Laboratories.

Leslie C. Whitney, of the author's company, presented a paper at the Annual Convention of The Wire Association in Atlantic City, N. J., in October, 1958, in which he dwelt upon the properties of the new wire. Mr. Leib has supplemented Mr. Whitney's paper by a discussion of the fields in which Alumoweld wire is finding applications.

The rapidly growing availability of aluminum has greatly increased its use in the design and construction of electrical transmission and distribution lines. This has led the forward thinking of the Copperweld Steel Company towards developing a new bimetallic wire, Alumoweld, to combine the conductance and corrosion resistance of aluminum with the strength of steel. Alumoweld fills the requirements for strengthening aluminum-type conductors, retains the advantageous properties of aluminum, and in general, does the jobs for aluminum conductors that Copperweld does for copper conductors.

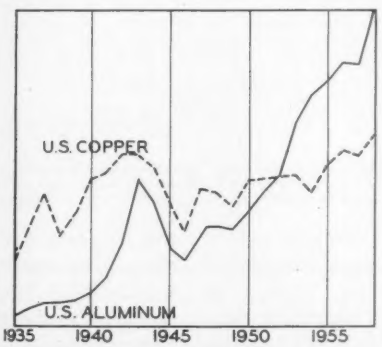

Fig. 1—Production of Aluminum and Copper in the U. S.

It has been said that the best criterion for the success of a new product is whether your customers ask for the product. If this is a true index, and it probably is, the future of Alumoweld is assured. Hundreds, perhaps a thousand inquiries to the Copperweld Steel Company have said, "Why Don't You Make an Aluminum-Type Copperweld?"

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Quite naturally then, work on an aluminum-covered steel wire was started several years ago. The first problem was to select a process. In the wire industry, most engineers are familiar with the manufacture of Copperweld (copper-covered steel) in which molten copper is cast around a steel ingot and the resulting large diameter bimetallic billet is hot rolled and then cold drawn into wire. This process has been successful for over 40 years and has been changed only in degrees which tend towards greater economy and improved quality control. It was logical, therefore, that this process be considered in the manufacture of aluminum-covered steel wire.

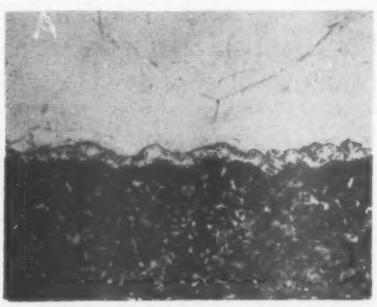

Fig. 2—Microphotograph shows ductile interface alloy formed when copper is molten-welded to steel.

Two major obstacles prevented use of the Copperweld process. The first was the low melting point of aluminum (approximately 1200° F.), which would not permit heating the steel to a temperature sufficiently high for rolling without first melting the aluminum. The second obstacle was the weld at the interface of the two metals. In copper-covered steel, the copper-iron compound formation is ductile and presents no problem. In aluminum-covered steel, the inter-metallic compound of aluminum and steel is a problem, as it is brittle. One of our major objectives was to avoid the compound, yet we knew that a metallurgical bond is essential for a wire to be drawn and to resist the normal handling abuse typical of overhead line construction. These paradoxical objectives ultimately led us to the development of a controlled weld.

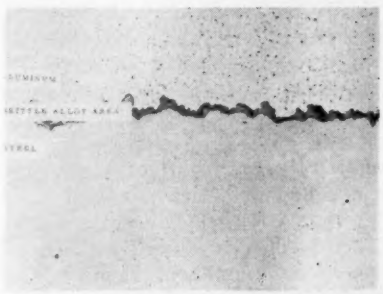

Fig. 3—Microphotograph showing brittle iron—aluminum alloy at interface of early aluminum-covered steel experimental wire.

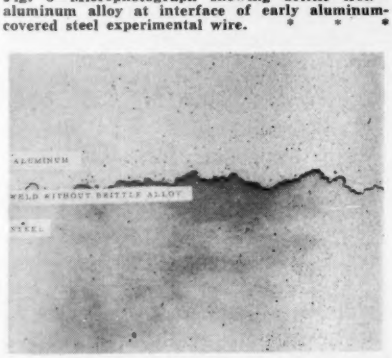

Fig. 4—Microphotograph showing controlled weld of present Alumoweld process, which results in a clean bond between the aluminum and the steel without brittle interface alloy.

The services of Battelle Memori-

al Institute at Columbus, Ohio, were engaged to search for the most suitable method to apply a heavy layer of aluminum over steel, and at the same time, provide a weld between the two metals without inter-metallic compound. After several early methods were explored, Battelle developed a continuous application of atomized aluminum powder metal onto steel rod, refining both the weld and the cladding with heat and pressure. The details of the process are restricted by Company policy and by patents pending, but the end results have exceeded the original hopes of the inventors and this new bimetallic rod is now being produced on a commercial basis. Also, it is being cold drawn into wires of sizes as used for overhead line applications.

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Experience with Copperweld over the years was helpful in deciding on the proportions of aluminum and steel. Although any reasonable proportion of aluminum and steel appears possible in the manufacturing process, the decision was made to concentrate on a design having 25% aluminum by area. The aluminum is concentrically or coaxially distributed over the outer cross section of the wire, providing sufficient corrosion resistance for field conditions. The low frequency electrical conductance is 33%, that is, three Alumoweld wires of a given diameter, when stranded together, will have the same direct current conductance as one EC aluminum wire of the same diameter. At high frequencies the conductance of an Alumoweld wire approaches 100% of pure aluminum due to skin effect.

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Tensile strength of the new wire was likewise an important consideration. Early experiments taught that it was easier to clad mild steels than high-strength steels. However, for overhead line construction, the need is for high-strength steels. After preliminary trials were successful on mild steel, a high-strength steel practice was developed to give tensile strengths in the order of those already in use for extra-high-strength Copperweld or for ACSR core wire. A special aluminum powder was also developed, suitable for a continuous production operation.

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The early makers of Copperweld adopted the aim of producing a wire which would develop the same life as copper under similar exposure conditions. For Alumoweld, the designers were guided by the similar objective that this material should be satisfactory in any atmosphere where EC grade aluminum is satisfactory. Since actual field tests require a considerable lapse of time, accelerated tests on laboratory samples were the immediate answer. Salt spray tests, smoke jacket tests and 100% humidity tests, all extended many times normal expectancy, showed the Alumoweld samples to perform similarly to all-aluminum samples. Even considering the short-comings of accelerated tests, a good confirmation of the long life of this material was established.

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To be still more conclusive, notches were filed through the aluminum covering into the steel of all the Alumoweld samples, simulating the field case where a wire might be abused in installation. Such abuse is not recommended, of course, but it appears to be not even a minor hazard in this bimetallic wire because the exposed steel is apparently protected by the surrounding aluminum.

★ ★ ★

Having assured ourselves, there remained the evaluation of others not directly involved in the development. Samples of this wire were submitted to over a hundred laboratories and companies throughout the United States and all reports received have been favorable. The product is now marketable and can stand as a companion to Copperweld wire.

★ ★ ★

Because of its aluminum surface, Alumoweld can be applied to reinforcing aluminum conductors, where Copperweld is not applicable. Applications fall into three classes, generally. In the first grouping are those where an aluminum surface is more or less essential. An example is core wire for ACSR conductors (aluminum wires and steel core wire or wires stranded together). In this application, Alumoweld provides a strength member or core wire having a life similar to the aluminum wires themselves. It also eliminates dissimilar metals in contact. Such contacts, under certain circumstances, can increase the rate of corrosion. An ACSR with equally coordinated life is now a reality.

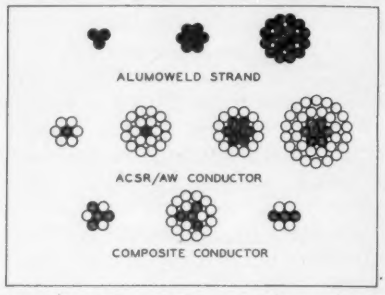

Fig. 5—Typical strandings of Alumoweld and aluminum wires.

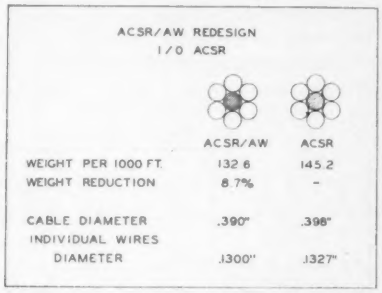

Fig. 6—For composite ACSR strands, weight and size can be reduced because of Alumoweld's high conductivity.

Several other advantages are noted for ACSR with Alumoweld core, known as ACSR/AW. The Alumoweld wires have a definite 25% of aluminum by area and this aluminum can be applied in the design of composite cables to marginally reduce the size of the aluminum wires, thus providing a compatible and non-rusting core with little increase in cost as compared to present designs. Another possible advantage lies in the stress-strain characteristics of the wire. In the 15% to 60% working range it is quite similar to standard ASTM core wire for ACSR and in the emergency range above 60% it can develop its ultimate strength with less permanent stretch.

★ ★ ★

Alumoweld wires may be in surface layers of ACSR strands, too. This is a relatively new concept. For example, 7-wire designs of ACSR need not be limited to the configuration of a single core wire with a layer of 6 aluminum wires over it. It now appears possible to have 2 Alumoweld wires diametrically opposite each other in the outer layer to provide added strength where required. Further, in single layer aluminum ACSR designs, the possible rusting of the core wire or wires close to the surface should not be a problem where the core wires are of Alumoweld. Another interesting Alumoweld application is for preformed armor rods and grips. These fittings may be used for dead-ending and splicing Alumoweld and aluminum-type conductors.

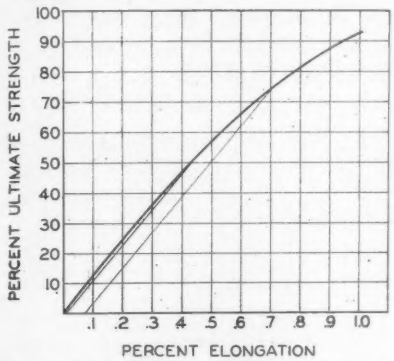

Fig. 7—Stress-Strain characteristics of No. 8 AWG Alumoweld wire.

In the second grouping of applications are uses where both Copperweld and Alumoweld are good. Typical of these are overhead ground wire, guy and messenger strand, and fence. Here, the choice between the two bimetallic wires will depend on the application, the atmosphere, and the economics, so decisions will probably be made locally. In Alumoweld's favor is the fact that it is 20% lighter than copper or Copperweld, and its per pound cost is less. In the case of guy and messenger strand, we have been favorably impressed with the hardness developed in the aluminum covering and its resultant ability to withstand normal abuse.

* * *

There is a third group of applications where Alumoweld may not be as well suited as Copperweld. One of these is insulated line wire. The larger diameter of Alumoweld for conductance equivalent to Copperweld would appear to be an economic disadvantage. Also, if carrier or radio frequencies are involved, Copperweld will probably be superior for electrical reasons, but the choice will be close.

* * *

At this point in the development of Alumoweld, many questions on application and design remain to be answered. Being primarily interested in high-strength electrical conductors, it is natural that we have concentrated on the overhead electrical conductor field. We recognize, however, that there are a host of applications not yet explored in both the electrical and mechanical fields. Concentrating on production has restricted experimentation, but expanding facilities now underway will soon lead into other proportions and combinations of metals as well as many new and varied applications. As of now, we are certain that Alumoweld wire is an excellent added tool for the overhead line engineer. It has the quality necessary for outdoor construction and its use will expand greatly over the years.

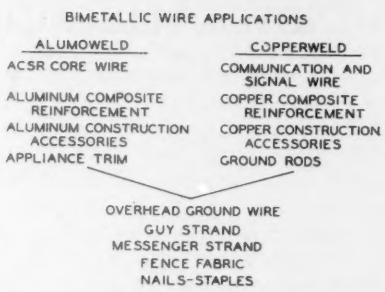

Fig. 8—Alumoweld and Copperweld applications.

Membership in The Wire Association Has Many Advantages

These are described in a booklet: "The Wire Association — What It Is and How It Functions." It will be mailed to you on request.

All wire men concerned with production or processing problems are eligible to become members. Send for the booklet.

THE WIRE ASSOCIATION

Richard E. Brown, *Executive Secretary*

453 MAIN STREET ● STAMFORD, CONN.

New Attachments Increase The Usefulness Of Spring Coilers

by E. E. Franks, Jr.
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Machine Division
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Torrington, Connecticut

This article traces the development of spring coiling accessories that have added greatly to the utility of many spring making machines.

There was relatively little change in the basic design of spring making machinery during the quarter century preceding World War II. The spring coiler of 1914 could produce open and close-wound, tapered and barrel springs or combinations of these shapes. While coiling machines were improved in details of construction, little was done to make the spring coiler of 1938 capable of producing a wider variety of shapes and forms of springs. The only real advancement was in the design of numerous special single-purpose machines for specific products such as bearing rolls, casings, and BX cable. All advances in coiler capacity were attained with special tooling and attachments installed by spring makers, without the active participation of spring-machine builders.

★ ★ ★

There began in 1940 and continues today, however, a new engineering attitude and marketing policy on the part of spring machine builders. This long-needed development was in large part sparked by the introduction of the torsion attachment, whose functional and commercial success was immediate. Since that time many special attachments and tooling designs have been developed, all of which have contributed to increased flexibility and usefulness of the basic coiling machine.

Torsion Spring Attachment

It was originally thought that the feed of the torsion spring attachment had to be intermittent. Thus, it was assumed necessary to feed the first end, then stop the feed while the end was bent around the arbor, then start the feed again to coil the body of the spring and repeat the process for the last end. In fact the first patent on the torsion attachment covered a mechanism that would do just this. It was found some time later that since the ratio of the velocity of the wire to the speed of rotation of the cam shaft was low enough, an intermittent wire feed was not necessary. The velocity curve of the wire feed on a segment coiler fulfills this condition ideally, while operation of a clutch-type coiler need not be intermittent when the feed is less than 125 in.

★ ★ ★

The torsion attachment makes it possible to produce simple torsion springs with straight ends on a spring coiler with a relatively small investment, considerably less than the cost of a torsion spring winder. While very little end forming can be done, and its accuracy at high speeds is not equal to that obtainable on a torsion winder, the torsion attachment filled a definite need in the spring industry. Moreover, it opened our eyes to the fact that there were possibly other attachments that might be made to extend the usefulness of the spring coiler.

Double Diameter and Double Pitch

A later attachment that proved very useful is the double-diameter mechanism. This device simply comprises an additional diameter control cam and linkage. It permits independent camming of diameter motions and simplifies the timing adjustments and the design of the cams. In many cases it permits the use of standard cams where previously it has been necessary to make special cams.

★ ★ ★

The double pitch mechanism has the same advantages for pitch control as the double diameter has for diameter control.

Long and Short Wire Feed Gears

An early development was the use of long wire feed gears for the segment coiler. It is possible with these gears to coil springs having a longer wire feed than the standard wire feed gears permit. Although the wire diameter capacity is reduced in proportion to the increase in feed length (a limitation later removed by introduction of the multiple feed mechanism, as discussed below), the net result is that the overall capacity and range of the machine is extended. These gears can be changed easily because they are on the outside of the rear housing, a convenience that was not previously possible.

★ ★ ★

Short wire feed gears are closely related attachments, although their purpose and advantages are different. What they really accomplish is to reduce the back-gearing ratio between the index clutch and feed rolls. Several advantages derive from this condition:

a) Greater accuracy of wire feed.

b) **Reduced loading on the index clutch, segment gear teeth, and crank gear adjusting block bearing, resulting in increased life for these parts.**

c) **Coiling machine runs more smoothly on short springs made of heavy wire. In most cases, production speeds can be increased with the short gears.**

Continuous Coiling Gears

Continuous coiling gears are an easy means of converting a segment coiler into a continuous coiler. They fulfill a definite need in coiling constant-diameter and constant-pitch springs of extreme length. One drawback in the use of continuous coiling gears is that the cutter mechanism cannot be used nor can any camming of pitch and diameter be accomplished.

Ring Coiling Attachment

The ring coiling attachment in Figure 1 is a relatively new development. Initially a device for coiling rings in a vertical plane, it consisted essentially of a special cutter attachment which permitted cutting large rings on the first coil. Prior to the development of this attachment, coiling machines were produced with a vertical cutter slide, which required cutting on the second coil. On large rings, especially if the wire diameter was comparatively small, the first coil had to be closely guided and confined in order to maintain accuracy. Without guiding, an increase in diameter of the first coil would subtract wire from the second coil and result in a ring with insufficient wire. Conversely, a ring with too much wire was also possible.

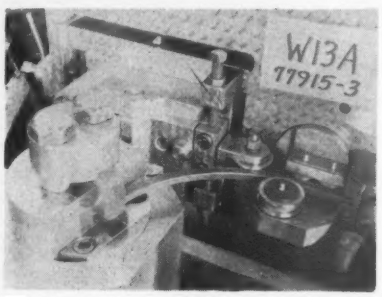


Fig. 1

* * *

Torrington's first ring coiling attachment corrected the latter fault by cutting the wire on the first coil, bu it was not always possible to cut squarely across the wire. The wire is still cut on the first coil in a more recent design, but the ring is now coiled in the horizontal plane. Furthermore, the cutter is adjustable so that the cut can always be made square with the axis of the wire—an important characteristic in coiling rings which have to be butt welded. This device again increased the scope of the machine, so that large rings can now be made.

* * *

As a matter of fact, there has been a more recent development whereby large rings which do not need to have an extremely accurate roundness can be made with very simple tooling. If you can allow a short straight section—½ in. in a 12-in.-diameter ring, for example—this new tooling will do the job.

Motorized Coiling Point

One of the problems that has always plagued spring makers, especially in operating the larger sizes of spring coilers, has been bending of the wire around the arbor when a new bundle of wire is started. It has been done with everything from screw drivers and the thin ends of old guides to pipes, and has been the cause of many broken tools and frayed tempers. In addition, the coiling point or roll had to be backed off with the loss of diameter setting.

* * *

As a means of solving this problem, the motorized coiling point holder in Figure 2 has been developed. The coiling point holder is mounted on a motor driven vertical slide. With push-button control, the slide can be moved out of the path of the straight first end of the bundle, the wire fed past the coiling point, and the coiling point then used to bend the wire around the arbor. Limit switches on the slide can be set so that the coiling point returns to the exact coiling position. Furthermore, there is an opening in the slide bracket so that, with the coiling point moved out of coiling position, the last end of a bundle can be fed out of the machine.

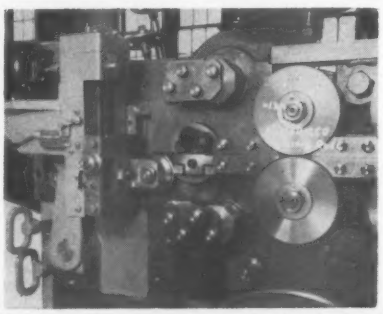


Fig. 2

* * *

Auxiliary Wire Feed

Occasionally it is desirable to feed a short length of wire on one or both ends of the spring, then stop the feed and form these lengths, both feeds being independent of the main feed for the body of the spring. An auxiliary feed mechanism has been developed for the segment coiler to provide this coiler action. The device consists of a cam-actuated index clutch mounted on one of the lower feed roll shafts. It makes possible the use of part of normal cutting time for feeding wire. During the auxiliary feed the main index clutch over-runs, and during the main feed the auxiliary index clutch does the same.

Single-Cycle Mechanism

The conventional method of operation of a spring coiler is continuous, one spring after another being made as long as the drive clutch is engaged. However, in certain cases where the spring coiler is but one of a combination of machines—as in automated production lines—it is desired to make only one spring at a given signal from some other element of the machine. This operating sequence is preferable to trying to synchronize a continually running machine.

* * *

Such a single-cycle mechanism has been developed by substituting an electric clutch-brake for the conventional manually-operated drive clutch. The clutch is disengaged by a cam-operated limit switch on the cam shaft of the spring coiler just after the cut takes place. The brake engages at

the same time. The clutch engages (and the brake disengages) on a signal from an external source (another machine in the line) so that one spring, and one spring only, is made. Because there is considerable time available on a segment coiler between the completion of the cut and the start of the next feed, the machine has time to attain the proper speed before the coiling begins. The clutch pulley is made heavier than normal to provide a greater flywheel effect.

★ ★ ★

The day will surely come—perhaps it is here already—when the professional spring maker will combine the spring coiler with other equipment for performing other operations on the spring. It has already been necessary to make the smaller sizes of coiler in bench-type designs in order to fit in physically with other equipment in such a system.

Rectangular Coiling Attachment

The rectangular coiling attachment in Figure 3 was developed originally during the war for making magazine springs. It consists

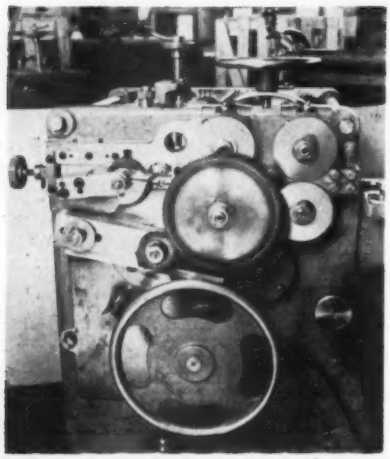


Fig. 3

of a rotating, lobed coiling point driven at a fixed speed in relation to the feed roll speed. The coiling point can have one constant radius sector and one recessed portion. In that case it will rotate once while the feed rolls are feeding a length of wire equal to one semicircular end and one straight side of the coil. The coiling point will make two revolutions per coil. The coiling attachment can be made with two constant-radius sectors and two recessed portions, in which case it rotates once per coil. While the constant-radius sector is adjacent to the arbor, it acts like a fixed coiling point and the round end of the coil is formed. When the recessed portion is opposite the arbor, the straight side of the coil is made. A torsion attachment could be used for the same purpose but would be much slower.

Electric Cut-Off

The electric cut-off was developed for clutch-type coilers primarily to produce long constant-diameter and constant-pitch springs where it was desired to measure the length of the spring. The length of wire is measured in conventional clutch-type coiler operation, so that variations in diameter of the spring throughout its length or from one spring to another will affect indicated spring length. Furthermore, in making long springs the speed of the cam shaft is so slow that some time is wasted during the cut. To overcome both of these conditions, the electric cut-off was developed.

★ ★ ★

This mechanism consists of a one-revolution solenoid-actuated clutch that gets its signal from a limit switch in a spring run-out trough. While the spring is being coiled, the cam shaft is not rotating and the feed clutch is engaged. When the first end of the spring strikes the limit switch, the one-revolution clutch is engaged and the cam shaft starts to rotate. First the feed clutch disengages, then the cut occurs and the feed clutch re-engages, after which the cam shaft stops, having made one revolution. The trough limit switch can be adjusted to determine the length of spring. The speed of rotation of the cam shaft can be relatively high, thus reducing the cutting time.

★ ★ ★

It is possible to do a certain amount of pitch or diameter forming on the extreme ends of the spring, as for example on garter springs, but no variations in pitch or diameter can be made in the spring body itself.

★ ★ ★

The electric cut-off is of particular value in coiling garage-door springs. The end relationship of domestic garage-door springs about 2 in. O.D. and 20 in. to 24 in. long has been held to within ± ¼ in. with this device. It has also been used with success on large torsion springs like those used on auto hoods and rear decks.

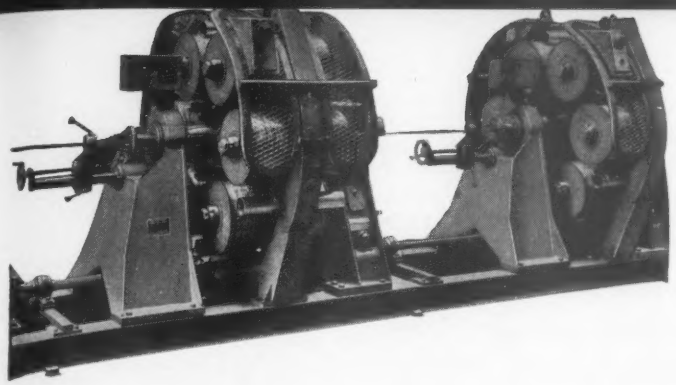
Skip-Cut Mechanism

Some years ago the skip-cut mechanism was introduced to permit coiling and cutting long constant-diameter and constant-pitch springs on segment type coilers. It consists of a two- or four-lobed cam follower which is substituted for the cutter cam roll. With the four-lobed cam, for example, the cutter cam rotates the lobed cam follower during three strokes of the segment without actuating the cutter. After the fourth stroke the cutter cam bears against a radial portion of the cam follower and the cutter is actuated to cut off the spring. Naturally, no pitch or diameter variation is possible, because the cam shaft rotates four times during the coiling of the spring. The feed is intermittent, but this condition is not noticeable in the finished spring. This mechanism was the next step, after the development of the continuous coiling attachment, in extending the feed of the segment coiler and it had the added advantage of cutting off automatically.

Multiple Feed Mechanism

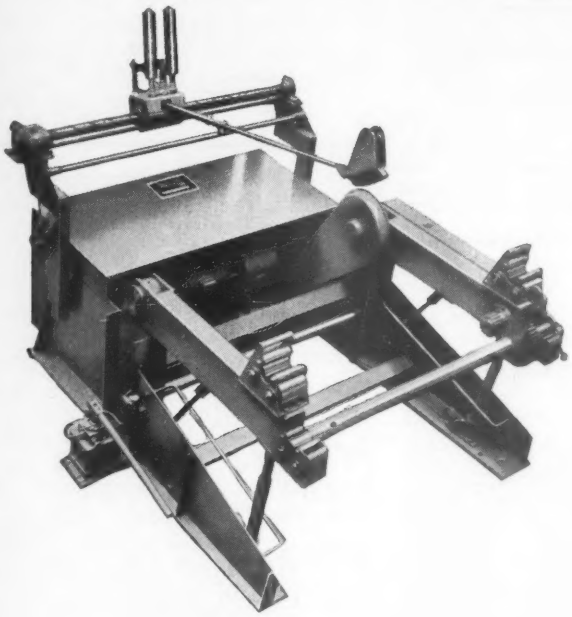
It has long been Torrington's objective to build into the segment coiler the capacity to coil long springs and at the same time to permit camming for variations in pitch and diameter. The continuous coiling attachment and the skip-cut were the first two steps but had the limitations mentioned above. The third step is the new multiple feed mechanism. With this device, it is possible to coil, cut and, using the pitch and diameter mechanism, at the same time square the ends of open-coil springs, or cone down the ends (or do both).

(*Please turn to page* 368)



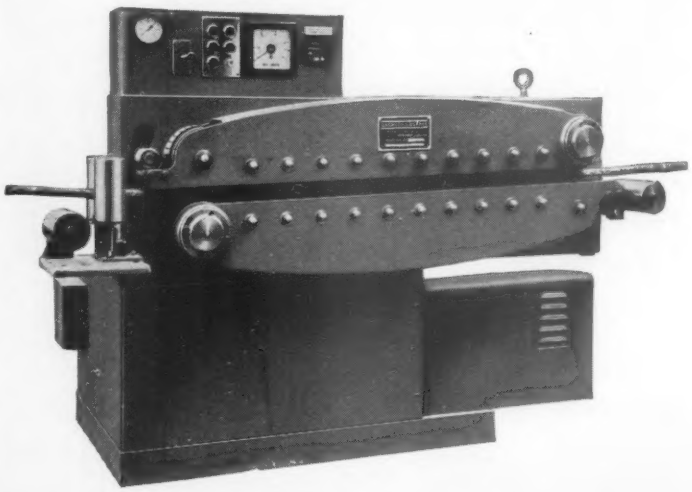
FIXED BOBBIN STRANDING MACHINE

The Larmuth & Bulmer Fixed Bobbin Stranding Machine produces high quality stranding at 50% higher speeds than the Sun and Planet method. Initial costs are low. Floor space is saved. Maintenance is reduced. Many automatic refinements are introduced.



INDEPENDENT TAKE-UP DRUM STAND

This Larmuth & Bulmer independent Take-up Drum Stand can be transported from one machine to another. A new traverse action automatically coils without the aid of the usual standby labour. Cable tension and stop mechanism is electrically controlled to dispense with the friction clutch method. Loading is eased by a hydraulic system.



CATERPILLAR HAUL-OFF

The Caterpillar Haul-Off uses endless belts of rubber shoes which fully protect the cable during haul-off. Grip may be pre-selected and simply controlled. It is positive and constant throughout operation. The unit does not require special foundations or the usual haul-off drum pit. It can be used as a reliable independent measuring device.

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Swaged Terminals in Boom Pendant Applications

by T. A. Aho
Assistant Chief Engineer
in collaboration with
J. L. Walmsley, Supervisor
J. M. Yankovich, Engineer
R. F. Joy, Engineer
Williamsport Plant
Bethlehem Steel Company
Williamsport, Pennsylvania

This article reports the results of tests to determine the most advantageous type of terminal for wire rope, the swaged terminal indicating definite superiority.

In the operation of mobile cranes, power shovels and similar construction equipment, no part takes more brutal punishment nor is exposed more constantly to the deteriorating effects of the elements than are the boom pendants, those all-important linkages of wire rope which back-stay the boom.

★ ★ ★

It's not just the weight of the boom and the load that play havoc with the pendants; it's the shock and the resultant vibration as the load is "picked," plus the effects of corrosion and abrasion of the strands from water and dirt that do the damage.

★ ★ ★

Many remedies have been tried. Recently, Bethlehem Steel Company concluded a series of exhaustive fatigue tests of boom pendants in a machine specially designed to reproduce as nearly as possible actual service conditions. The first series tested various types of end terminals, using uncoated rope. The second test series compared uncoated, galvanized, and bethanized ropes utilizing the best end terminal as determined by the first test series.

★ ★ ★

Drop-forged swaged terminals were found to have the longest fatigue life of all end fittings tested, with the following order of superiority of the end fittings resulting: 1) swaged terminal, 2) torpedo loop-lock, 3) aluminum sleeve-lock, 4) zinc socket, 5) hand tuck splice.

★ ★ ★

Having proved the superiority of the swaged terminal, the second series was run to determine if zinc-coated wire ropes (aside from their known resistance to corrosion) might not show longer service life under identical test conditions.

★ ★ ★

As the accompanying graph shows, best results in this test series were obtained with our bethanized rope, that is, rope in which the individual wires are zinc-coated electrolytically and then drawn to finished wire size. These specimens lasted up to 400,000 test cycles before strand failure, or twice the number of cycles obtained with uncoated rope. Ordinary galvanized rope lasted 260,000 cycles, or about 60,000 cycles more than uncoated rope. These figures prove that greater resistance to fatigue exists in bethanized rope than in either galvanized or uncoated wire rope. Bethanized wire rope, with its field-proven corrosion resistance, combined with the swaged terminal, makes an unbeatable team for boom pendant service.

Special Machine Designed for Tests

For the tests, our research de-

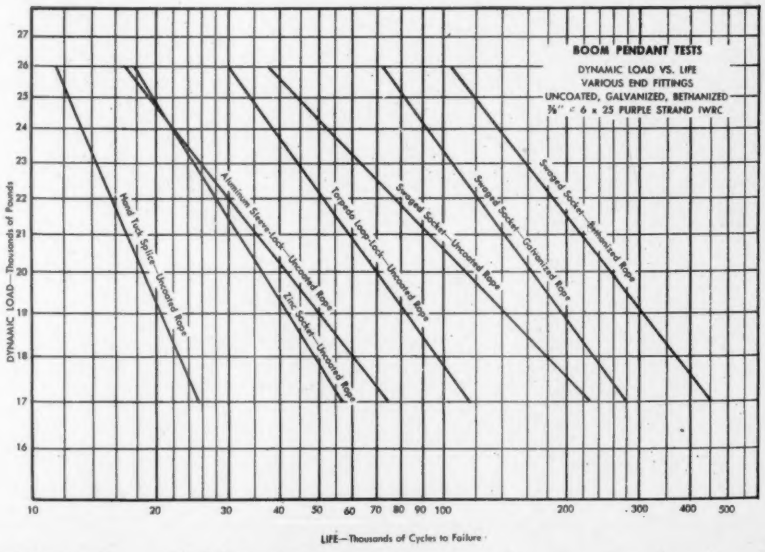


Figure 1—Boom pendant test results.

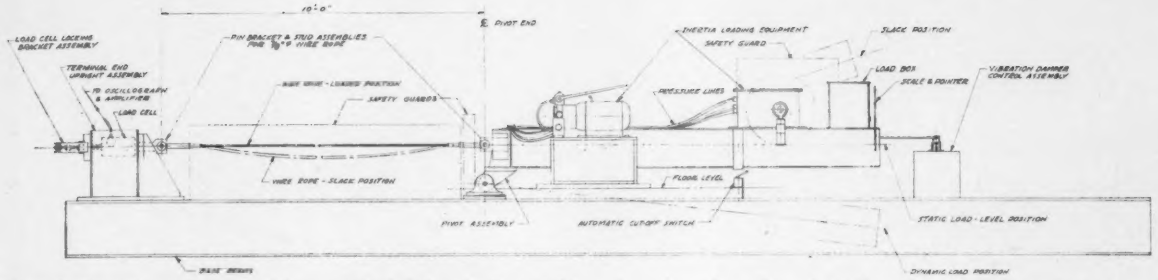


Figure 2—General arrangement of boom pendant fatigue testing machine. * * * * * * * * * * * *

partment built a machine capable of applying up to 30,000 pounds dynamic longitudinal load in wire rope. It simulates the vibrational stresses occurring in boom pendants on operating cranes, shovels, etc.

★ ★ ★

Load measurement is taken at the dead end anchorage of the specimen by means of a 50,000-lb. type U-1 load cell with amplifier and oscillograph. The rope terminal fitting is attached to a stud assembly threaded into the back of the load cell. An adjusting nut permits movement of the whole load cell assembly to compensate for permanent stretch in the rope or small differences in the initial length of the test specimens. This adjustment is used to maintain a level beam with static load in the rope in order to measure consistent drop height during dynamic loading.

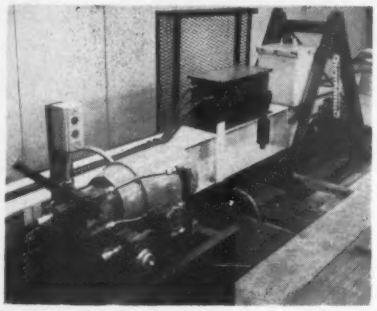
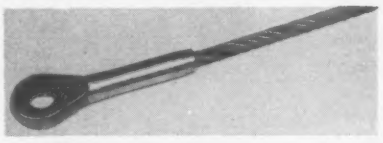


Figure 3 * * * * * *

At the other end of the specimen the fitting is attached to a horizontal pin at the pivoted end of a cantilevered beam. At the free end of the beam, 10 feet from the pivot, is a box for additional weights. By adjusting the weight in the box and/or the drop height (the distance above the static load level position from which the beam is released or to which it rebounds) various dynamic loads can be achieved. Dynamic load is approximately three times static load.



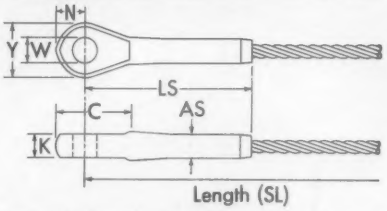


Figure 4—Swaged Terminal * * *

Figure 5—Specimen in testing position under static load. * * * * * *

★ ★ ★

Operating on the inertia principle, the machine uses as its driving means the centrifugal force resulting from rotating weights in resonance with the rope beam system. It is operated at approximately 120 loading cycles per minute. The inertia drive consists of an enclosed hydraulic motor with variable weights attached to an externally rotating shaft. By changing these weights and their distance from the shaft various centrifugal forces can be obtained. The speed of rotation of the weights can be adjusted to operate the beam in the resonant frequency range.

★ ★ ★

A counter attached to the beam records the number of loadings, a pointer and scale measure drop height, and an automatic cut-off switch is actuated if too large a deflection, excessive stretch, or rope failure causes the beam to fall too far.

Procedure of Testing

Two successive series of tests were run, the first to determine the best terminal fitting; the second, the best rope. Our uncoated 7/8" diameter Formset Purple Strand IWRC wire rope was used in the terminal tests. Five different types of end fittings were used with it: 1) hand tuck splice, 2) zinc socket, 3) aluminum sleeve-lock, 4) torpedo-lock, 5) swaged socket. All pendants, except aluminum sleeve-lock, were fabricated by normal shop procedures at the company's Williamsport, Pa., wire rope plant. In the case of the aluminum sleeve-lock, rope from the same reel was sent to a company which makes this type of fitting for fabrication.

★ ★ ★

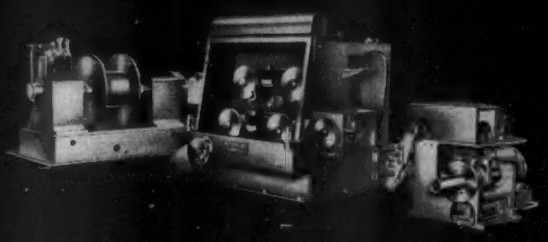
With the superiority of the swaged terminal conclusively proven, only this fitting was used during the testing of the three types of rope: uncoated, galvanized, and bethanized.

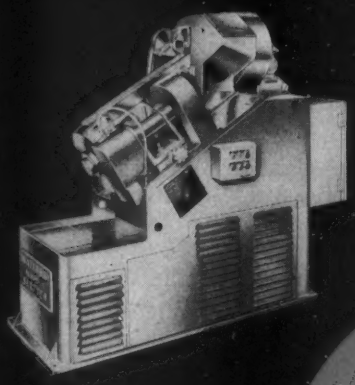
★ ★ ★

During the tests the loads on the specimens were maintained within plus or minus 600 pounds,

(*Please turn to page* 375)

COLD HEADING
MACHINERY

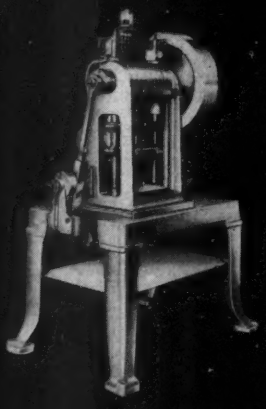


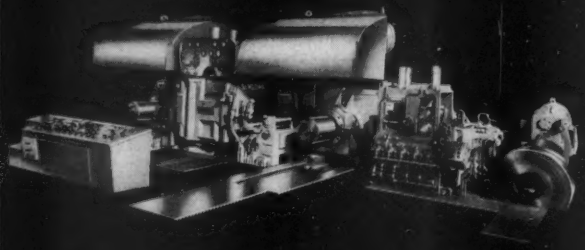


EYELET, SLITTER
& WIRE
MACHINERY

WATERBURY
MACHINERY BUILDERS
FARREL

ROLLING MILL
MACHINERY

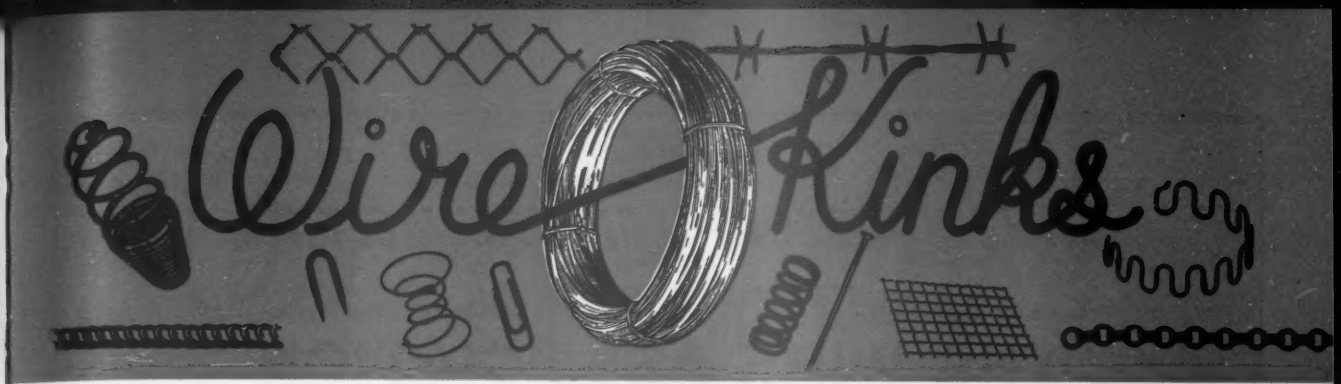




POWER
PRESSES

THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC.
Waterbury, Connecticut • U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

WF-56



How To Find The Rope Capacity of a Reel

While the length of rope that may be wound upon a reel varies with the uniformity of winding, with normal tension and uniform winding, the following formula will apply. There will be an appreciable error if the traverse width is small in relation to the flange diameter.

B = Traverse width in inches.
D = Drum diameter.
H = Flange diameter.
$A = \frac{H-D}{2}$ — Desired clearance in inches between diameter of full load and flange diam.
K = Constant obtained by dividing .2618 by the square of the rope diam.
$L = (A+D) \times A \times B \times K$
= Rope length in feet.

—Courtesy Wire Rope Corp. of America, St. Joseph, Mo.

New Type Connectors for Coaxial Cables

A new line of connectors for Phelps-Dodge aluminum sheathed coaxial cables has been developed, said to embody some interesting features.

★ ★ ★

High mechanical strength and gas tight seal are made possible by self threading sleeve and supported flare.

★ ★ ★

Unique design of center contact holds center conductor of cable securely and provides for expansion and contraction—center contacts cannot spring open.

★ ★ ★

Supporting bead for center contact is injection molded in place, permitting close tolerances to be maintained.

Do you have how-to-do-it items for this department? To make it a success we are depending on readers to send us material drawn from their own experience and observation. Your cooperation will be appreciated by us and our many readers.

A two piece adapter construction minimizes the electrolysis problem.

★ ★ ★

The connectors withstand considerably more than the allowable pulling tension of the cables.

★ ★ ★

Simple design insures correct and rapid installation by inexperienced labor . . . consistency is guaranteed by one piece assembly tool (optional) no matter who makes the installation.

—Courtesy of Elden, Inc., Bethesda, Md.

Tighten Bolts to Yield Strength?

Actually, it is safer to "overtighten" than to undertighten. The following explains why.

★ ★ ★

Up to yield point, the strain in a bolt is proportional to stress. **Beyond** the elastic limit, the bolt goes into its "plastic range." Some permanent stretch takes place (Fig. 1). Yet while the bolt will not return to original length, note that **residual tension** is fully maintained. And remember, it's **this** force that keeps a bolt tight, determines joint strength.

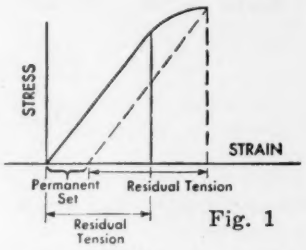


Fig. 1

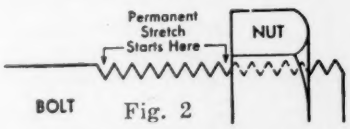


Fig. 2

The permanent set starts at section with highest unit stress—which is at the unengaged threads (Fig. 2). Ultimately, this throws thread pitch off and nut locks, subjecting bolt to torsion (rather than further tightening). This force disappears with wrench-removal. Thus, a bolt can even be torqued well into its plastic range if it won't be reused or need adjustment.

—Courtesy of Russell, Burdsall & Ward Bolt & Nut Co.

Do You Have Mice?

A new self-setting, aquatic, all-steel mousetrap capable of catching over 100 mice at a single setting has been developed.

★ ★ ★

Neither poison nor electricity is used in the trap. Instead, the trap's ramps and dumping mechanisms are actuated by the weight of the mouse. The trap is 15½" x 3" x 15" and weighs 12 lbs. It has a water chamber which is filled with 2½ quarts of water.

★ ★ ★

Here's how the trap works: The rodent is enticed into one of two entrances at the bottom of the trap by the smell of food hidden in a

THE HOUSTON REGIONAL MEETING

FERROUS DIVISION

THE WIRE ASSOCIATION

MAY 7-8, 1959 • SHAMROCK HOTEL • HOUSTON, TEXAS

On to Texas in May for a good meeting—
and to experience Texas hospitality!

THE PROGRAM

THURSDAY, MAY 7th

9:00 A.M.—Registration

12:00 Noon—Luncheon for Program Participants

2:00 P.M.—Technical Session

Chairman of Meeting

T. B. DULL, Superintendent of Wire Mills, Sheffield Div., Armco Steel Corp., Kansas City, Mo.

PAPER: "Developments in the Production of Bolt and Nut and Forged Products" by R. C. RHOADES, Works Mgr., Sheffield Div., Armco Steel Corp., Kansas City, Mo.

PAPER: "Use of Pressure Dies for Better Lubrication in the Drawing of Steel Wire" by EARL A. BOWERS, Vice Pres., Standard Industrial Compounds Co., Frankfort, Ill.

PAPER: "The Production of Stainless Steel Wire" by GILBERT C. KLINGEL, Mill Representative, Baltimore Works, Armco Steel Corp., Baltimore, Md.

PAPER: "The Production of High Carbon Steel Wire" by STEWART S. GRAY, Asst. Vice Pres., Union Wire Rope Corp., Kansas City, Mo.

6:30-7:30 P.M.—Cocktail Hour—Courtesy of a number of companies.

7:30 P.M.—Dinner. Ladies invited to attend.

FRIDAY, MAY 8th

9:00 A.M.—Plant Tour: Wire mill of Sheffield Div., Armco Steel Corp. at Houston.

1:00 P.M.—Texas Barbecue at the Texaco Country Club.

***For the Ladies:* A tour of interesting points about the city has been arranged.**

All steel wire men, from every corner of the country, will find this Regional Meeting rewarding and very much worth while. William L. Dull, Superintendent of Wire Mills at Houston, as Chairman of the Program Committee, extends a cordial invitation to all to attend.

Make your plans now to go to Houston

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET • **STAMFORD, CONN.**

Wire Kinks

separate chamber. Once the mouse enters the hole he walks up and tips a seesaw-like ramp. This causes a trap door on the entrance to close and set up the trap for the next mouse. It also bars the trapped mouse from the food chamber.

★ ★ ★

A tiny pinhole of light at the top of the trap lures the mouse into climbing a built-in ladder. Once on top the mouse is attracted by another pinhole of light on the other side of the trap, and walks to it. The weight of the mouse causes the ramp on which it is walking to tip sideways and drops the mouse into the water filled tank where it drowns.

★ ★ ★

Another design feature of the trap is that it is fabricated from corrosion resistant sheet steel made by Republic Steel. Keeping the trap free of rust is essential since it has a number of delicately balanced parts which must work freely.

★ ★ ★

Only three operations are needed to set the trap. These consist of (1) filling the water chamber, (2) inserting bait in tray, (3) pressing set buttons to open both doors.

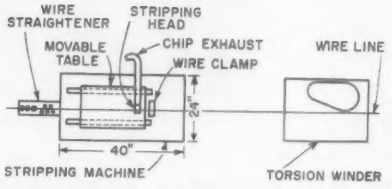
★ ★ ★

Actually, the trap is a duplex arrangement, for entrance holes are located at either end of the unit. Each entrance has its own door, levers and ladder leading to the water tank drop.

—Courtesy of Self-Set Mousetrap Co., Cleveland, Ohio.

Wire Stripping

The problem here was to strip the nylon coating from the ends of circuit breaker coils preparatory to soldering.



Plan view of stripping machine.

For this job an electric stripping machine was placed between the payoff reel and the torsion winder. As the winding head began the recoil stroke and the wire was motionless, a signal from a cam-operated limit switch on the torsion winder actuated the stripping mechanism. The machine was timed to strip only that portion of the wire which would appear on the ends of the finished spring. Since a 3/16" strip was needed on each end, the machine stripped 3/8" at a time.

★ ★ ★

The stripper consists essentially of a stripping head, a clamping device and a traveling table assembly. In the stripping head are mounted four knives which revolve about the wire at high speed and turn down the insulation to the depth desired. The clamping device holds the wire stationary while the table assembly carries the knives back along the wire line. The knives open automatically when the required length of wire has been stripped.

★ ★ ★

The machine follows this sequence of operations:

1. **Winding head begins recoil stroke. Wire is stationary.**
2. **Limit switch sends signal back to stripper.**
3. **Wire is clamped just forward of the stripping head.**
4. **Rotating knives bite into insulation.**
5. **Table assembly moves away from clamp. After required distance knives open.**
6. **Table assembly returns to original position, ready for next cycle.**

★ ★ ★

A number of controls are provided to increase the machine's versatility. The depth to which the knives cut is adjustable for various wire diameters and thicknesses of insulation. The length of wire stripped is controlled by a stop-knob which automatically opens the knives when the desired amount of insulation has been removed.

★ ★ ★

The position of the stripping head along the wire line is adjustable within four inches. When the length of the coil is changed, the position of the stripped segment can be changed correspondingly. If moving the head four inches fails to reposition the strip on the ends of the coil, the entire stripping machine may be moved toward or away from the torsion winder. Fine adjustment may then be made within the four inches provided.

★ ★ ★

The production speed of the stripping machine is determined by the length of the strip: the longer the strip, the lower the speed. As set up for this application, the machine can strip a maximum of sixty springs a minute.

★ ★ ★

To insure accurate stripping, the knife blades must be properly ground for each wire size and type of insulation. An exhaust system is used to prevent chips from fouling the knives, and a wire straightener is mounted on the entry side of the stripping machine, thus guaranteeing uniform stripping when the wire passes between the blades.

—Courtesy of Torrington Mfg. Co., Machine Div., Torrington, Conn.

Boulin Announces New Tachometer

The Boulin Instrument Corporation has announced the addition to their line of tachometers, an outstanding unit known as "Tri-Tach". This precision, low-cost Centrifugal Hand Tachometer, offers many features not found in more expensive instruments. Manufactured in Western Germany, this unit represents the finest in craftsmanship, accuracy and dependability. Here are just a few of the many features found in the Tri-Tach:

1. **Accuracy ± 0.5%.**
2. **Through a reflecting mirror on the dial parallax errors are eliminated. This feature is usually only found on equipment selling at much higher prices.**
3. **Pointer rotates 675° providing a scale length of over 13½ inches with a dial of only 2⅞" in diameter—an exclusive feature. The instrument weighs twelve ounces.**
4. **A stop button locks the pointer at any speed as a reminder of the reading until the next speed check.**
5. **Furnished complete with accessories, all packaged in a carrying case with instructions.**

Boulin "Tri-Tach." * * * * *

6. **In three ranges Tri-Tach measures from 40 to 40,000 R.P.M. or 20 to 20,000 F.P.M.**

★ ★ ★

Complete information on the Tri-Tach will be provided by the Boulin Instrument Corp., 10 First St. Pelham, N. Y.

New Snap-In Filter

A snap-in filter that will give maximum air filtration at an approximate cost of only 6¢ per month per unit has been developed by **Extraer Inc.**

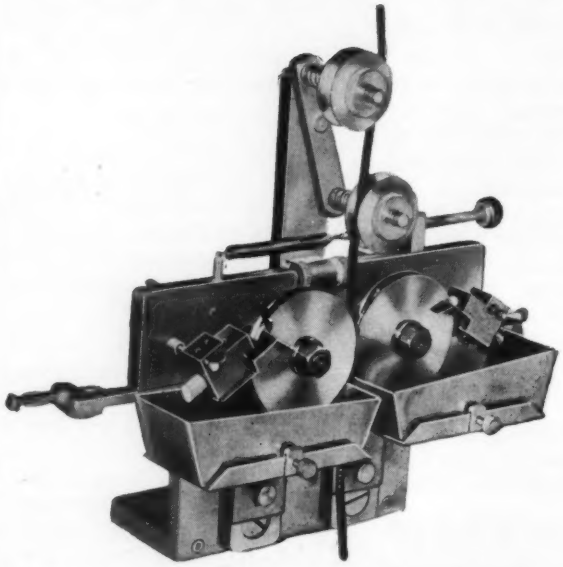
★ ★ ★

The company, which specializes in filtration, designed the new filter to meet the needs of industry for top efficiency filtration at a low cost, and with minimum installation and disposal expense. It consists of a flexible steel frame with a metal grid and a snap ring to hold the disposable filter pads in place, which are made of a fluff acetate material. The pads are completely inert, and have the highest efficiency ratings compared to other filter media. After their usefulness as a filtering material ends they may be used as dusting or wiping rags.

★ ★ ★

Manufactured by Extraer Inc., 1210 Chenevert, Houston, Texas, who will supply detailed information.

MARKING WHEELS and MACHINES for ELECTRIC WIRE



Gillies Engraved Concave and flat marking wheels are widely used printing the I.P.C.E.A. color code, numerical, semi-spiral striped, dating, or manufacturer's identification, etc. on insulated wire, tubing or hose.

Machines print on ONE or BOTH SIDES in large legible letters. Wheels are adaptable to any machine—or we will supply the machines.

Wheels, shafts, ink pans and all accessories are readily removable for quick and easy cleaning.

Wheels are made of TOOL STEEL, HARDENED to Rockwell test 61-64 and HARD CHROME PLATED.

Send for samples of wire and prices on wheels and equipment.

"There is no substitute for QUALITY when combined with SERVICE"

DUNCAN M. GILLIES CO., INC.

POST OFFICE BOX 181
WEST BOYLSTON, MASS.

Telephone: West Boylston TE 5-4445

New Aluminum Clad Copper Wire

An aluminum clad copper wire designed for use in the production of high temperature magnet wire and a variety of electrical conductor applications in aircraft, missiles, and other high speed industrial equipment, has been announced by **Sylvania Electric Products Inc.**, Warren, Pa.

★ ★ ★

Richard E. Corcoran, product sales manager of Sylvania's Parts Division, said that the new high temperature wire, which consists of an aluminum alloy cladding over a high conductivity copper core, has applications both as magnet wire and as high temperature lead-in wire.

★ ★ ★

The new wire features all the advantages of an aluminum surface and, in addition, offers a conductivity approaching that of copper. The aluminum surface can be anodized for insulation, he added.

★ ★ ★

The aluminum alloy measures approximately 40% of the cross-sectional area. At room temperature the conductivity of the new Sylvania wire is close to 70% that of copper.

New Wire Motor Mount for Small Motors

A new twin-arm type of wire motor mount permits reductions in shaft height of ¼-inch or more over conventional stamping-type mounts by allowing base of motor frame to nest between its two parallel base wires. This feature, in combination with light weight, is particularly suited to air-conditioning units, portable appliances, and other applications where overall compactness is a major design objective.

★ ★ ★

Because of the natural resiliency and vibration-dampening characteristics of wire construction, the new mount also permits improved decibel ratings. The open configuration allows unrestricted air circulation and reduces air turbulence.

Wire Men Who Want Reel Balance

Turn to **APCO MOSSBERG** *First*

Close tolerances make a big difference in high speed wire processing. That's why Apco Mossberg steel reels, spools and bobbins are custom-designed to meet your *exact* specifications in size, shape, balance and trueness.

Apco's precision all-steel construction assures smooth spool-out without wire breakage or trapping . . . keeps machine downtime to the minimum . . . keeps your production rate up to date. What's more, you get a strong, safe, wire-processing package that pays off in substantial on-the-line economies.

Wire, write or phone collect for preliminary recommendations. If it's reel balance you want, Apco Mossberg has the answer that makes real sense.

PACIFIC COAST REPRESENTATIVE:
Gordon Proffitt
World Trade Center
Ferry Building
San Francisco 11, California

CANADIAN REPRESENTATIVE:
Hugh P. Williams & Co.
47 Colburne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

WIRE

BACKED BY A HALF CENTURY OF EXPERIENCE

- **Sizes up to 9/16"...**

  . . . down to almost the size of a human hair, in low carbon and medium low carbon steels.

- **Wire of many finishes**

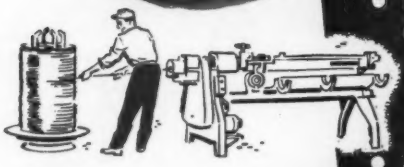
  the right wire for the job—coppered, tinned, bright, galvanized and other finishes to fit your production needs.

- **Better forming and workability**

  Continental Wire is available in almost any temper and analysis in low and medium low carbon steels for your particular forming jobs.

- **Metallurgical service**

  Thousands of case histories provide unsurpassed resources for developing a practical solution to your wire problems.



ECONO-COIL—Reduces scrap loss up to 90 percent. Saves material handling time. The Econo-Coil gives you continuous length wire coils of 2000# to 3000# catchweight, in sizes from 12 gage through ½" diameter. Shipped on returnable Econo-Coil reels.

LEVERPAK—Mechanizes your wire handling, protects wire against moisture, dirt and handling damage. LEVERPAK permits long uninterrupted runs of 500# to 650#, depending on wire sizes. Saves scrap, downtime, stores easily.

SPECIAL SHAPES—D-shaped, V-shaped, oval, half-oval, half-round, square, rectangular, triangular, keystone-shaped and others. Saves fabricating and machining costs.

Chances are you have a problem right now that we can help you solve—with Wire. Call us.

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STEEL CORPORATION • KOKOMO, INDIANA

Wire Specialists for over Half a Century

PRODUCERS OF Manufacturer's Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special shaped wire. Also Welded Wire Reinforcing Fabric, Nails, Continental Chain Link Fence, and other products.

The twin-arm mounts are manufactured in conformance with present NEMA specifications, and can support the motor vertically or horizontally.

★ ★ ★

Dimensions, wire gauge, and bolt battern can be modified to meet customer specifications. For further information, write **E. H. Titchener & Company,** 67 Clinton St., Binghamton, N. Y.

British Iron and Steel Industry Translation Service

A translation of any article on iron and steel manufacture in the foreign technical press can now be provided at a fraction of the translating cost, provided that three requests for it are received by the British Iron and Steel Industry Translation Service.

★ ★ ★

This Service is run by **The Iron and Steel Institute** with the collaboration of several large companies and of the **British Iron and Steel Research Association.** Some 530 translations are already available, a large portion of them from German or Russian.

★ ★ ★

Requests for new translations are invited from all, members and non-members alike, in Great Britain and abroad. Anyone requiring a translation of an article on iron and steel manufacture should send a request to B.I.S.I.T.S., who will check that no translation already exists, and then circulate particulars to members (and some others). Then, if further requests are received, B.I.S.I.T.S. will commission a translation; if only one other company is interested, it and the original enquirer are invited to share the cost of translation. When no other requests are received, B.I.S.I.T.S. can arrange a translation privately; if it is needed urgently it is made at once, without waiting for the above procedure.

★ ★ ★

A complete list of the first year's translation, classified by subject, is now available. Enquiries are welcomed and should be addressed to the British Iron and Steel Industry Translation Service, The Iron and Steel Institute, 4 Grosvenor Gardens, London S.W.1., England.

Aluminium Conductor Manufacture in India

The first reel of aluminum conductor manufactured at the new works of **The Aluminum Industries Limited,** Kundara, Kerala State — India's largest manufacturers of aluminum conductors and accessories — was handed over to **Mr. M. S. Thirumale Iyengar,** Chief Engineer, Hirakud Dam Project, at Hirakud in Orissa State, on January 16, at a function presided over by **Mr. Sailendra Narain Bhanj Deo,** Minister of Works, Orissa State. A large gathering of officials, company executives and others attended.

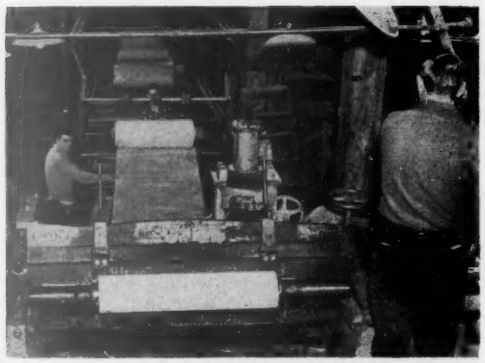
* * *

Mr. B. V. D. Menon, Director of the company, welcomed the gathering. He said that the chief reason that prompted the company to locate the plant at Hirakud was that the Indian Aluminum Company, their principal raw material supplier, who had already had an aluminum smelter in Kerala State,

V. G. G. Nayar handing symbolic small reel on a platter to M. S. Thirumale Tyengar. * * *

CARRIS CUSTOMERS GET

Better Reels



Because We Manufacture Our Own Plywood and Pass the Savings on to You!

....AT

Better Prices!

Carris reels are quality-controlled right from the very beginning: with the manufacture of our own plywood. In this way we know that the plywood that goes into our reels is of the very finest quality . . . and since we save money in the process, we can cut our prices proportionately.

For the finest in non-returnable and returnable spools and reels, contact us! We manufacture to specifications and offer both regular and special delivery service!

Call PRospect 3-7388

CARRIS REELS
INCORPORATED
RUTLAND, VERMONT
SPECIALISTS IN THE DESIGN AND MANUFACTURE OF PLYWOOD REELS AND SPOOLS

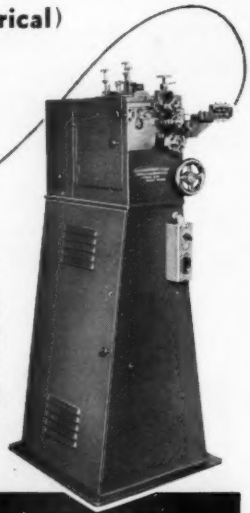
THE MOST COMPLETE LINE OF SPRING MAKING MACHINERY . . .

DESIGNED AND BUILT FOR THE METAL WORKING INDUSTRY

Sleeper & Hartley produce a complete line of spring-making machinery serving the basic metal working industries:

- **Fabricated Metal Products**
- **Instruments**
- **Ordnance**
- **Furniture and Fixtures**
- **Transportation Equipment**
- **Electrical Machinery**
- **Machinery (except electrical)**
- **Miscellaneous Products**

Quality and dependable service during 47 years of Sleeper & Hartley production have given the customer satisfaction for which we constantly strive.



No. 0 UNIVERSAL SPRING COILER, ESCAPEMENT TYPE. Series 720 — 73" Model.
This newest, versatile machine in the exclusive S&H escapement line incorporates the most advanced design engineering in the field, to give greater wire feed range and high speed production. Its many features include extremely accurate wire feed and controls for fine precision adjustment. Inertia is minimized since the only thing that starts and stops with this type feed mechanism is the wire itself.

Write for latest information . . .

SLEEPER & HARTLEY, INC., BOX 1249, WORCESTER 1, MASS., U.S.A.

was building their new 10,000-ton smelter at Kirakud.

★ ★ ★

Presenting the Project Report of the new works, **Mr. R. K. Nair,** Project Engineer, said that the total floor area of the factory buildings was a little over 50,000 sq. ft. and that a considerable quantity of aluminum sheets had been used for roofing and side-cladding, and aluminum conductors for electric power and lighting wiring.

★ ★ ★

Requesting Mr. Thirumale Iyengar to accept the reel, **Mr. V. G. G. Nayar,** General Manager, said that the reel crystallized in itself the experience of the company as pioneer manufacturers of aluminum conductors — an experience acquired through the manufacture of 150,000 miles of conductors, and that it was indeed a happy augury for Alind to have Mr. Iyengar as the first customer of this new works, whose very touch has spelt success to so many outstanding engineering projects in this country.

New Active Resistive Rosin Flux

A new, activated rosin flux that leaves an unusually resistive residue after heating has just been introduced by **Alpha Metals, Inc.,** producers of high purity metals, solders, solder preforms and a full line of flux and soldering chemicals.

★ ★ ★

Such a flux is Alpha 610. In its raw state it has relatively low conductivity. During soldering, the rosin's conductive constituents are destroyed and the flux residue becomes highly resistive.

★ ★ ★

Among the other advantages of this flux are its qualities of instant wetting, excellent capillary action and a moderate drying rate. It is especially valuable in printed wiring applications, such as those found in the production of computers, and other critical circuitry work.

★ ★ ★

Alpha 610 Flux is available in 1

gallon, 5 gallon and 54 gallon units. For technical information on the new flux, write to Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J.

Cobalt

The Cobalt Information Center announces the availability of a new illustrated quarterly review, **Cobalt.**

★ ★ ★

This journal (published both in French and English) will present articles of general interest, technical articles on the varied uses of cobalt and its alloys, reports on cobalt research and development projects sponsored by the Centre d'Information du Cobalt, abstracts of current U.S. and European literature on cobalt, and news items of interest to cobalt users. It will replace the monthly publication "Literature Abstract Bulletin," which has been discontinued.

★ ★ ★

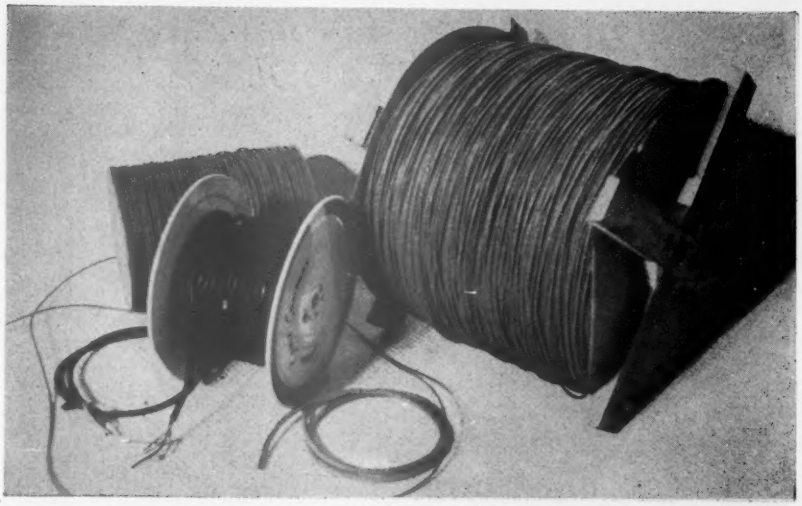
The first issue of **Cobalt** features technical articles on "The Uses of Cobalt" and "High-Temperature Alloys." "The Uses of Cobalt" includes information on world production and U.S. consumption, a historical survey of early uses, uses in numerous cobalt alloys, uses of cobalt compounds, radioactive cobalt, electroplated cobalt, and cobalt in biochemical sciences. "High-Temperature Alloys" presents applications and compositions of heat-resistant alloys, properties of superalloys, and future prospects. A section containing 68 abstracts from the current technical literature is also included.

★ ★ ★

Interested persons may obtain this issue by addressing requests on company letterhead to the Cobalt Information Center, c/o Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio. Requests outside the Americas should be directed to Centre d'Information du Cobalt, 35, rue des Colonies, Brussels, Belgium.

New Mill for Tungsten and Moly

The Fenn Manufacturing Company, Newington, Conn., builders



For High Tensile Strength, Specify

TEXTILENE GLASCOR*

Soft, dry fillers for portable and flexible cords, Textilene Glascor and Twi-Port have wide acceptance. Fiberglas-centered Glascor is exceptionally strong without added bulk or sacrifice of pliability. It goes into S, SJ, and SV cords with 18, 16, and 14 gauge conductors — Twi-Port into S and SJ cords with 12 gauge and larger conductors. Successful applications include control, appliance, and power cables; telephone drop wire; communications and coaxial cables.

Twitchell's superior Textilene line also includes: Fungus-resistant filler — *Twi-Tar.* Used for buried communications cable, expanded ACSR cable, and in other applications.

Moisture-resistant fillers—*Twi-Flex* and *Twi-Wax.* Used for non-metallic sheathed cable, maritime shipboard cable, varnished cambric cable.

*Patent No. 2832190

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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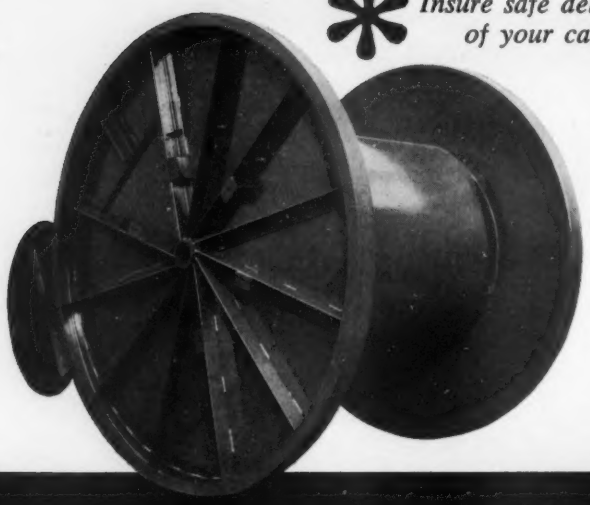
PAPER PRODUCTS FOR THE WIRE INDUSTRY

Twisted • Folded • Pressed • Crushed • Shaped • Braided • Woven

Insure safe delivery of your cable with



NYECO Steel Shipping Reels

124-INCH DIAMETER
50 TON CAPACITY
STEEL REEL
For oil filled cable.
Designed and fabricated for the GENERAL CABLE CORPORATION, Bayonne, N. J.

MODERNIZE and enjoy greater protection against damage in shipping and processing with NYECO steel reels. Rugged, weather-resistant, splinter-proof, warp-proof... protects costly cable against damage due to dropping, bouncing, rough handling. Cost little more than wooden reels... last up to 10 times longer ...require minimum maintenance. Protect your investment and reputation by using NYECO steel reels.

YOUR INQUIRIES WILL RECEIVE OUR PROMPT ATTENTION

Send specifications for STEEL SHIPPING REELS, IMPREGNATING REELS, PROCESSING REELS, SUBMARINE CABLE REELS AND BRIDGE REELS. Prompt deliveries on large or small orders.

NYECO ALSO MANUFACTURES

- Impregnating Tanks
- Caterpiller Take-ups
- Floor Rolls
- Stands
- Vulcanizers
- Cabling Machines
- Pressure Vessels

ANY QUANTITY — ANY SIZE — ANY LOAD FLANGE DIAMETER from 36" up

Specialists to the wire industries for over 50 years.

NYECO

NEW YORK ENGINEERING COMPANY

of precision rolling mills and allied metal forming equipment, has built a Two-High 12" Reversing Rod Mill especially for hot rolling of Tungsten and Molybdenum. Equipped with 12" diameter by 24" face special grooved rolls, the mill will roll 2⅛" diameter billets to both 1¼" diameters at variable production speeds from 60 to 180 fpm.

★ ★ ★

Special features of this precision mill include motorized screwdown with either simultaneous or independent infinite adjustment of each adjusting screw driven by separate 3 HP motors; a forced feed lubrication system with lubricant reservoir self-contained in the heavy stress relieved steel bed; hydraulic roll lifters; and special running-in-and-out tables and guides. The mill is powered by a 70 HP variable speed fast-reversing DC drive.

G.E. Appoints Distributor

Appointment of Arthur A. Crafts Co., Inc., 10340 W. Berteau, Schiller Park, Ill., as an authorized limited line distributor of Carboloy cutting tool products in Central Illinois was announced by the Metallurgical Products Department of General Electric Company, Detroit.

★ ★ ★

The Crafts organization, founded more than 50 years ago, will carry a full local stock of finished standard items such as toolholders, standard tools, inserts, wheel dressers, masonry drills, and boring tools. Crafts representatives are trained in the application of Carboloy cemented carbides and cutting tool products.

To Sell —

Advertise in

WIRE AND WIRE PRODUCTS

It pays —

Send for rates

453 Main St., Stamford, Conn.

Outstanding Personalities of the Wire Industry

Chase Brass Advances Two Men

David M. Andrews, formerly superintendent of maintenance there, has been advanced to general superintendent of the Chase Metal Works plant in Waterville, Conn. It is a division of **Chase Brass & Copper Co.,** Waterbury, fabricating subsidiary of Kennecott Copper Corporation.

* * *

Succeeding Mr. Andrews as superintendent of maintenance is **George A. Finn, Jr.** who moves up from his previous post as maintenance engineering supervisor. Both promotions, immediately effective, were announced today by **H. F. O'Shaughnessy,** Works Manager.

Ansonia Names Chief Chemist

The appointment of **Souren Mouradjian** as Chief Chemist is announced by **Ansonia Wire & Cable Company,** Ashton, R. I., pioneers in the development and manufacture of plastic insulated wires and cables.

* * *

Mr. Mouradjian's experience in plastics and in wire and cable manufacture is extensive. He joins Ansonia from **Royal Electric Corporation,** a division of I. T. & T., where he served as Plastics Engineer. Prior to that experience he was Plastics Engineer with U. S. Rubber Company's wire and cable plant in Bristol, R. I.

Souren Mouradjian

* * *

A graduate of Brown University, he holds a Bachelor of Science degree in Chemistry. In addition, he majored in Engineering at Rutgers University in the Army Specialized Training Program during World War II.

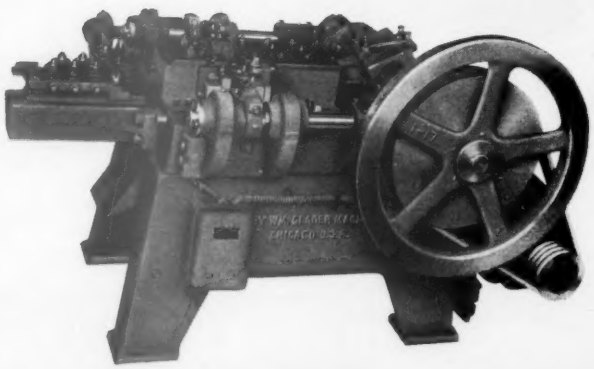
Atkinson Joins Brookfield Wire

John M. Richardson, President of **Brookfield Wire Co.,** Brookfield, Mass., has announced the appointment of **Howard J. Atkinson** as Regional Sales Manager. He comes to Brookfield from the **Riverside Alloy Metal Div.** of **H. K. Porter Co.,** where he had been a sales engineer.

GLADER NAIL MACHINE

a NAME and MACHINE
that have stood for
DEPENDABILITY since 1887

our Nail Machine
"KNOW-HOW"
means $$$ for you



Wm. GLADER MACHINE WORKS
210 N. RACINE AVENUE
CHICAGO 7, ILLINOIS

EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

U. S. Industrial Chemicals Appointments

Byron J. Anderson, Plant Manager of **U. S. Industrial Chemicals Company's** new plant at Houston, Texas, has announced the following appointments.

★ ★ ★

T. Howard Dantzler has been made Superintendent of Operations; **E. P. Richards** was made Chief Engineer; and **Eugene C. Carlson** was appointed Technical Superintendent.

U.S.I. Opens West Coast Office

U. S. I. has established a San Francisco Sales Office, it has just been announced by **Alden R. Ludlow,** Sales Vice President of the **U. S. Industrial Chemicals Co.,** Division of National Distillers and Chemical Corporation. **Kenneth Fietz,** who will be San Francisco Manager, has been a representative of the firm's New York Sales Division for the past sixteen years. He will report to **Robert E. Alexander,** Pacific Coast Division Manager at Los Angeles.

★ ★ ★

The new sales office was created to help keep pace with the needs of customers for U. S. I. products in central and northern California and the states of Oregon and Washington. The address of the new office is 220 Montgomery St., San Francisco 4, Calif.

New District Manager For Chase at Dallas

Promotion of **Clifton D. McCarra** to district manager of the **Chase Brass & Copper Co.** warehouse and office in Dallas, Tex., was announced this week by General Sales Manager **Walter E. Evans.** His appointment is effective at once and McCarra succeeds **A. M. Johnson,** who was recently promoted to district manager for Chase in Chicago.

★ ★ ★

He started with Chase in May, 1946, as an inside salesman at Houston, Tex., and soon was promoted to office manager there. In April, 1948, he was promoted to office manager at Dallas and for the past year has been an outside salesman.

To Direct Plastic Materials Research

Ralph M. Knight has been named Manager of Polyolefin Planning and Applications for **U. S. Industrial Chemicals Co.,** Division of National Distillers and Chemical Corporation. In his new position, Mr. Knight will be responsible for long-range planning and coordination of U. S. I.'s polymer development program. He will also direct the Company's Polymer Service Laboratories located at Tuscola, Illinois. The appointment was announced by **Dr. Robert E. Hulse,** Executive Vice President of National Distillers, and General Manager of the U. S. I. Division. Mr. Knight will

ROLLER BEARING

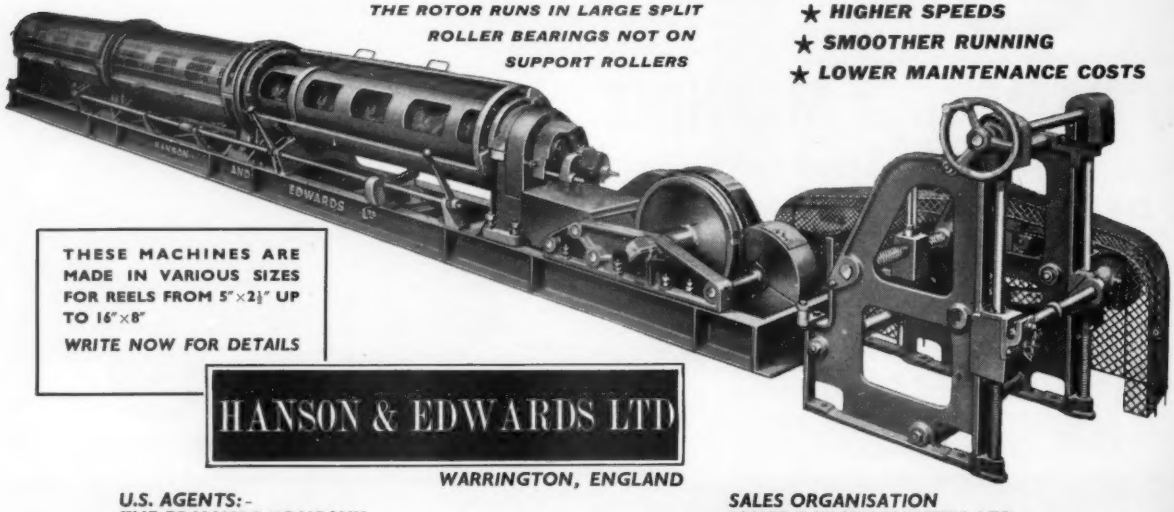
TYPE TUBULAR

STRANDING MACHINE

(EITHER SINGLE OR DOUBLE CAPSTAN)

THE ROTOR RUNS IN LARGE SPLIT ROLLER BEARINGS NOT ON SUPPORT ROLLERS

★ *HIGHER SPEEDS*
★ *SMOOTHER RUNNING*
★ *LOWER MAINTENANCE COSTS*



THESE MACHINES ARE MADE IN VARIOUS SIZES FOR REELS FROM 5"×2½" UP TO 16"×8"
WRITE NOW FOR DETAILS

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WARRINGTON, ENGLAND

U.S. AGENTS:-
THE EDMANDS COMPANY
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CRANSTON 10, R.I.

SALES ORGANISATION
JAMES DAY (MACHINERY) LTD.
28 MADDOX STREET
LONDON, W.1.

P 1686

report directly to Dr. Hulse and to **W. P. Marsh, Jr.**, Vice President of National Distillers and Assistant General Manager of U. S. I.

* * *

U. S. Industrial Chemicals Co. is the country's third largest producer of polyethylene, which it markets under the trade name Petrothene. The company has underway an extensive polyolefin research and development program.

Named Production Manager

William H. Rader has been named Petrothene Polyethylene Production Manager for **U. S. Industrial Chemicals Co.**, Division of National Distillers and Chemical Corporation. The new appointment was announced by **Robert H. Cornwell**, Vice President in Charge of Production.

* * *

Mr. Rader joined National Distillers in 1953 as Senior Technologist and served as Senior Development Engineer in charge of polyethylene development operations at the company's Tuscola plant. At the time of his appointment he was Assistant Polyethylene Production Manager. He is a graduate of the Illinois Institute of Technology and holds a B. S. in Chemical Engineering.

Ansonia Wire & Cable Appointments Announced

John Marsh has been designated as Vice President in charge of Industrial Sales of **Ansonia Wire & Cable Company**, Ashton, Rhode Island. Mr. Marsh was formerly Ansonia's Market Specialist for the power utility industry. In his new capacity he will be based at Ashton.

* * *

Tilden E. Thompson has been named Vice President in charge of Telephone & Government Sales. Mr. Thompson, who was formerly Ansonia's Regional Sales Supervisor for the West Coast, also will work out of Ashton.

* * *

Frederick E. Corcoran was promoted to Assistant Secretary and Assistant Treasurer. He will continue as Ansonia's Office Manager in charge of Sales.

* * *

The announcements were made by **Frederick Kenner**, President of the Rhode Island concern, who stated that the appointments became effective as of the first of February.

Chase Brass Advances Several Sales Executives

The promition of several sales executives to new positions and responsibilities was announced by **George B. Moseley**, Vice President-Sales for **Chase Brass & Copper Co.**, a subsidiary of **Kennecott Copper Corporation.**

* * *

Paul M. Thomas, formerly Midwestern Regional Manager, has been named Manager of Mill Sales, making his headquarters at the Waterbury main office of the com-

(ILLUSTRATED)
42" x 20" x 21"—(4000# cap.)

HEAVY DUTY
BREAK-DOWN REELS

1000#
2000#
4000#
} capacities

Rugged Design including patented DURA-CURL rim, and many other features necessary to provide the *Strength* and *Durability* needed for continued successful performance.

Also complete line of sizes of Modern High Speed Wire Drawing NO-CREV Spools and Reels for both fine and intermediate size wire.

Mossberg PRESSED STEEL Corporation
"Division of Wauskuck Co."
18 WEST ST., ATTLEBORO, MASS., U.S.A.

Telephone
Attleboro 1-0848

#101

pany and reporting to Walter E. Evans, General Sales Manager. All Regional Managers will be responsible to Mr. Thomas in his new position.

★ ★ ★

Wallace L. Brown, Chicago District Manager since 1951, has been advanced to Midwestern Regional Manager replacing Mr. Thomas. In Chicago, Mr. Brown in turn will be succeeded as District Manager by **Alfred M. Johnson** who had held a similar post in the Dallas, Texas district since 1956.

★ ★ ★

Herman H. Kremer, a former staff manager and more recently on a special sales assignment, has been appointed Manager of Marketing Staff, also reporting to the General Sales Manager. The product managers for rod, wire and forgings, sheet and strip, tube and fittings will report to Mr. Kremer as will the Manager of Product Development.

★ ★ ★

John L. Cotsworth has been named Manager of Warehouse Sales under General Sales Manager W. E. Evans, retaining his responsibilities as product manager for stainless steel and aluminum.

★ ★ ★

Albert I. Blank has been promoted to Manager of Product Development, a new position in the sales department. With the firm since 1937 and Chief Process Metallurgist for the Chase Research Dept. at Waterbury since 1955, he will be responsible for organizing all phases of the product development program under the direction of Mr. Kremer as Manager of Marketing Staff.

G.E. Silicone Department Appointments

Joseph C. Caprino has been appointed Sales Engineer for the Chicago District of the Silicone Products Department, **General Electric Company,** with headquarters at 840 South Canal St., Chicago, Ill.

Royal V. Mackey, Jr., has been appointed Representative for the Upstate New York Territory, located at department headquarters, Waterford, New York.

★ ★ ★

Leonard J. Sacks has been appointed Sales Representative for the Eastern District, with offices at 1405 Locust St., Philadelphia, Pa.

New Works Manager at Chase Metal Works

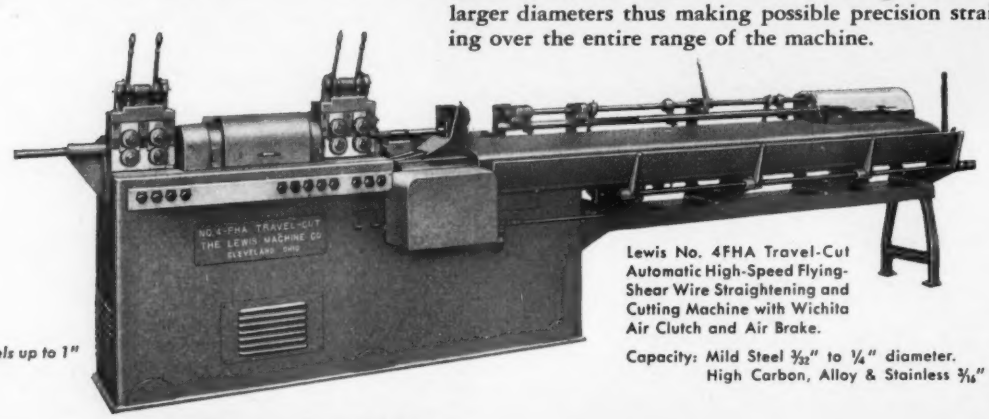
Promotion of **Henry F. O'Shaughnessy** to the position of Works Manager of the Chase Metal Works was announced by **Gilbert R. Boutin,** Vice President — Operations, **Chase Brass & Copper Co.,** a subsidiary of Kennecott Copper Corporation. Mr. O'Shaughnessy's promotion is effective at once and he succeeds Mr. Boutin, whose election as Vice President of the brass concern was made known last month.

★ ★ ★

STRAIGHTEN AND CUT WIRE UP TO 500 FPM

This is the most outstanding development in the field . . . the new Lewis No. 4FHA Wire Straightening and Cutting Machine designed to straighten and cut wire in any lengths at speeds up to 500 FPM.

Through the use of a compound sliding-gear transmission 24 gear combinations permit 20 feed speeds — 75 through 520 FPM with 6 flywheel speeds of 95 through 305 RPM. Another outstanding feature is the Dual-Center Straightener Arbor (Pat. Pending) permitting the use of close centers for small diameters and long centers for the larger diameters thus making possible precision straightening over the entire range of the machine.



Lewis No. 4FHA Travel-Cut Automatic High-Speed Flying-Shear Wire Straightening and Cutting Machine with Wichita Air Clutch and Air Brake.

Capacity: Mild Steel 3/32" to 1/4" diameter. High Carbon, Alloy & Stainless 3/16" Maximum.

Other models up to 1"

THE LEWIS MACHINE COMPANY

3441 EAST 76TH STREET • CLEVELAND 27, OHIO

Mr. O'Shaughnessy started as a trainee with Chase in April, 1950. He held various foremanships in the Sheet and Tube mills, was assigned to Production Control in Oct. 1954, and following the disastrous flood of Aug. 1955 was put in charge of coordinating the electrical rehabilitation of the big brass mill. In Dec. 1955 he was promoted to Administrative Engineer, with responsibility for planning and control of the Engineering and Maintenance dept. In June, 1957, he was promoted to General Superintendent, from which position he now moves up to the top administrative post in the Metal Works.

Nichols Appoints New Division Manager

Howard L. Jorgensen has been appointed Sales Manager of its Central Division by the **Nichols Wire & Aluminum Co.**, Davenport, Iowa. He replaces **Joseph H. Luebbe** who has retired.

* * *

Mr. Jorgensen has been associated with the Nichols Company for eight years as sales representative. He is a graduate of Western Reserve University and served as Captain in the Field Artillery during World War II.

* * *

The company also announces the transfer of its Central Division Sales Office from Cincinnati to the Hanna Building, Cleveland, Ohio.

Howard L. Jorgensen

Associated Spring Personnel Changes

Several changes in personnel have been made by **Associated Spring Corporation.**

* * *

Joseph F. Pitcavage, assistant factory manager at the Raymond Manufacturing Division, Corry, Pa., becomes manager of Associated Spring of Puerto Rico, Inc. **E. W. Feldt,** general manager of the Raymond Divison, assumes the additional duties of vice-president of the Puerto Rican subsidiary.

* * *

William A. Anderson, who as vice-president and general manager established Associated Spring of Puerto Rico, is moving to Florida to become a Corporate special sales representative.

* * *

Ross O. Bailey, personnel manager at the Raymond Manufacturing Division, replaces Mr. Pitcavage there as assistant factory

LOW COST precision wire plating

MAINTAIN UNIFORM COATINGS AT HIGH SPEEDS!

CONTINUOUS ELECTROPLATING EQUIPMENT

This low cost equipment performs with ease and efficiency that mean real savings. Preset quality control insures perfection without depending on operators' skill. No toxic fumes, clean operation at low temperature, elimination of work hardening during processing and many other features are the result of experience and sound engineering that go into the design of all Universal equipment.

We furnish complete installation . . .
For further information write to:

UNIVERSAL INDUSTRIAL EQUIPMENT CO.
SECAUCUS, NEW JERSEY SOLE AGENT IN CANADA: E. V. LARSON CO., LTD., TORONTO, CANADA

U. S. PATENT #2823180 AND FOREIGN PATENTS PENDING

manager. **William H. Helmintoller,** assistant personnel manager, assumes the duties of personnel manager.

★ ★ ★

Robert A. Bell, product engineer at the Gibson Division, Chicago, has been promoted to chief product engineer of the Division.

★ ★ ★

Kenneth R. West, product engineer, has been made assistant chief engineer of the B-G-R Division, Plymouth and Ann Arbor, Mich.

New Office Opened by G.E.

A new sales territory has recently been opened by the Silicone Products Department, **General Electric Company,** located at 2375 Hampton Ave., St. Louis, Mo. **Frank C. Janda** has been placed in charge of this new territory.

★ ★ ★

A 1951 graduate of DePaul University with a Bachelor of Science degree in chemistry, Mr. Janda received several years experience as a sales engineer within the chemical and petroleum industry, prior to joining General Electric in March, 1956.

Kaiser Appoints Branch Manager

Kaiser Aluminum & Chemical Sales, Inc., announces the appointment of **John E. Muller** to the position of Spokane, Washington, branch manager.

★ ★ ★

Mr. Muller formerly was an electrical conductor sales supervisor in the company's Los Angeles district. He has also served as a salesman in the Spokane branch and as a member of the mill planning department of the Trentwood, Washington, rolling mill. He joined Kaiser Aluminum in 1953 as an administrative assistant at the Trentwood plant.

New Harper Superintendent

The appointment of **Charles L. Harper** as plant superintendent of the **H. M. Harper Company's** Metals Division has been announced by **H. M. Harper,** president of the Morton Grove, Ill. firm. **Kenneth G. Hookanson** has been named director of research and development.

N. E. High Carbon Engineer Made Officer

Willard F. Blanchard, chief metallurgist, has been named executive vice president of the **New England High Carbon Wire Company** of Millbury, Mass.

Made Southern Regional Manager

Silicones Division, Union Carbide Corporation announces the appointment of **C. T. Schieman, Jr.,** Southern region manager (Atlanta) to the position of sales manager in the general office in New York, in charge of customer sales activities. He reports to **L. J. Sinnott,** general sales manager.

★ ★ ★

T. J. Fontelieu, director of silicone rubber sales in the Eastern region (New York) was appointed

FOR SALE

COMPLETE TEFLON EXTRUSION EQUIPMENT

2 JENNINGS 1½" EXTRUDERS

1 JENNINGS 2" EXTRUDER

1 ENTWISTLE STRIPER

1 RESPOOLER

Furnaces, payoffs, take-ups, sparkers and all electrical controls and test equipment.

As suppliers of Silver Plated wires to the Teflon Industry, we have decided to discontinue the manufacture of extruded Teflon wire. We could not conscientiously compete with our customers, therefore we are very happy to continue as suppliers of Silver Plate.

HUDSON WIRE COMPANY

OSSINING DIVISION

OSSINING, N. Y.

Southern region manager, succeeding Mr. Schieman.

Joins Riverside-Alloy as Assistant General Manager

Dwight A. Wrigley has been appointed Assistant General Manager at **Riverside-Alloy Metal Division, H. K. Porter Company, Inc.,** according to an announcement by **W. Harvey Thompson,** Vice President and General Manager. He will aid

Dwight A. Wrigley

in the coordination of the major departments and activities at Riverside-Alloy.

* * *

The appointment of Mr. Wrigley filled the vacancy left when **J. C. Hydrick,** former Assistant General Manager, was named to head Porter's Disston Division.

* * *

Prior to joining Porter, late in 1958, he was chief engineer for Narragansett Wire Company, Pawtucket, R. I. He had served in sales, management and engineering with the wire company for seven years. Previous to that, he was chief products engineer at the Instrument Division of Thomas A. Edison, Inc.

* * *

A graduate of the U. S. Naval Academy in 1935 and of Massachusetts Institute of Technology Graduate School in 1937, he holds a degree as Master of Science in Aeronautical Engineering.

Reynolds Elects Two V.P.'s

Two new vice presidents of **Reynolds Aluminum Sales Company** were announced by **David P. Reynolds,** executive vice president of **Reynolds Metals Company.** They are **Keith E. Hall,** general manager of industrial market sales, and **Alfred H. Williams, Jr.,** general manager of architectural and building products market sales.

* * *

Mr. Hall was graduated from the University of Oregon in 1930 with a B. S. degree. He came with Reynolds Metals Company in October 1946, and was stationed in the company's Washington office before being transferred to Louisville, Ky. He was made director of industrial markets in December 1956, and general manager of industrial markets in December 1957.

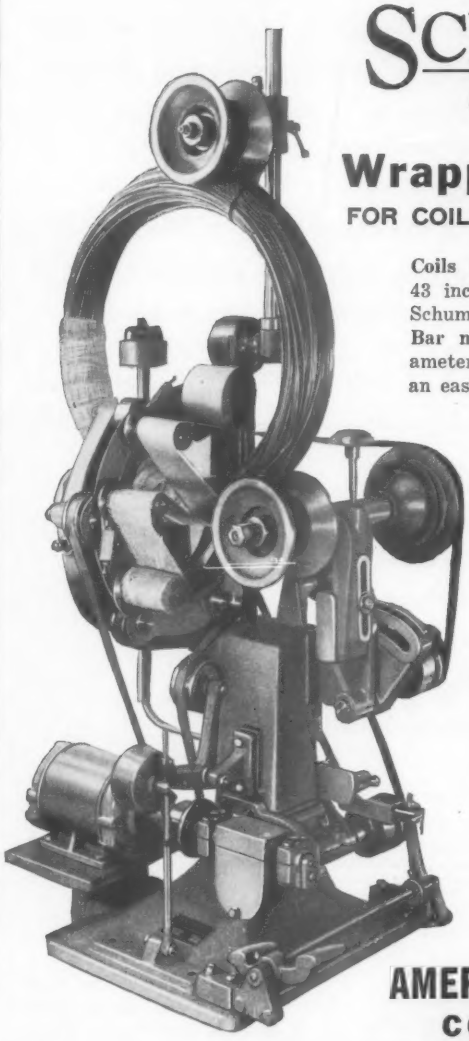
* * *

Mr. Williams attended the University of Virginia and became associated with Reynolds Metals Company in September 1954, as general manager of window sales. In October 1957, he was promoted

(*Please turn to page* 376)

SCHUMAG
AACHEN

Wrapping Machine
FOR COILS, BARS AND BUNDLES



Coils with outside diameters up to 43 inches are handled by the basic Schumag WS 2a machine illustrated. Bar material up to 6 inches in diameter is handled by the addition of an easily attached auxiliary device.

Outstanding Features

- Coils, bars and bundles automatically wrapped tightly and smoothly.
- Solidly guided open wrapping ring.
- Precision adjustment of wrapping-band tension. Once set, tension remains constant.
- Adjustable wrapping pitch. Special ranges available on order.
- Automatic shut-off of wrapping mechanism, adjustable for any size of coil.

Write for descriptive literature, or send us your wrapping specifications

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A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.
Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,867,262, MACHINES FOR STRAIGHTENING WIRE LEADS OF ELECTRIC COMPONENTS BY ROLLING SAID LEADS BETWEEN SURFACES OF TAPERING PRESSURE MEMBERS, patented January 6, 1959 by John Richard Ainsworth, John L. Lutyens, and Alan White, Leicester, England, assignors to United Shoe Machine Corporation, Flemington, N. J., a corporation of New Jersey.

The machine includes rollers having evenly-spaced, tapering peripheral faces, and a pair of lead-engaging members yieldably mounted for cooperation with the successive tapered faces and having lead-engaging surfaces complementary to the tapering faces. There is a rotating feeding device operated at a slower speed than that of the lead-engaging members.

★ ★ ★

No. 2,867,313, METHOD AND APPARATUS FOR ARRANGING AND FEEDING WIRE FILAMENTS, patented January 6, 1959 by Zoltan Deshaw, London, and Heinz Deshaw, Ilford, England, assignors to Ismay Lamps Limited, Ilford, England, a British company.

Coiled wire filaments are automatically fed from a disordered mass thereof to a delivery point with the filaments arranged by the mechanism disclosed in a predetermined orientation.

★ ★ ★

No. 2,868,159, WIRE COATING APPARATUS, patented January 13, 1959 by Harry B. Lit and Richard P. Anderson, Pittsfield, Mass., assignors to General Electric Company, a New York corporation.

Included in the apparatus is a baffle for providing a symmetrical flow of liquid coating material around the wire in the vicinity of a die which is adapted to reduce the thickness of the coating on the wire.

★ ★ ★

No. 2,868,236, APPARATUS FOR MAKING WIRE ARTICLES, patented January 13. 1959 by Clarence J. Smith, Rockford, Ill., assignor, by mesne assignments, to W. F. and John Barnes Company, Rockford, Ill., a corporation of Illinois.

This apparatus is stated to be adapted for undulating and bending a continuous length of wire into a zig-zag form for then fashioning various articles.

★ ★ ★

No. 2,868,237, WIRE BENDING APPARATUS, patented January 13, 1959 by Sam Larkin, New York, N. Y.

Here the wire is bent into a flat U-form having a turn of a coil at each end of its base. There are 12 claims.

★ ★ ★

No. 2,868,267, WIRE COILING MACHINE WITH ROTATING MANDREL AND COILING TOOLS, patented January 13, 1959 by Stephen A. Platt, Grand Haven, Mich.

The machine is adapted to produce bent wire articles, such as resistance wires for heater coils for furnaces and ovens.

★ ★ ★

No. 2,868,268, COIL-FORMING MACHINE WITH GENERATOR CONTROLLED SPINDLE POSITIONING MEANS, patented January 13, 1959 by Thomas E. Lewis, Jr., and Victor A. Zaveruha, Trumbull, Conn., assignors to The Coulter & McKenzie Machine Co., Inc., Bridgeport, Conn., a corporation of Connecticut.

★ ★ ★

It is an object of this invention to pro-

WIRE AND WIRE PRODUCTS

A monthly magazine established in 1926 to serve the entire wire industry. It has grown steadily in stature and influence through the years and today, in addition to reaching all American wire mills, has subscribers in 36 foreign countries in the free world.

It is the only publication in this country that is devoted solely and wholly to the manufacture, processing and application of wire and wire products, including electric wire and cable.

The industry is comprised of mills drawing ferrous and nonferrous wire and mills or plants fabricating products made entirely or principally from wire.

Wire men need and read the magazine widely. Articles are authoritative and timely.

Subscribe to and read

WIRE & WIRE PRODUCTS

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A monthly publication devoted to the interests of rod, wire and strip mills, insulated wire and cable manufacturers, wire formers and fabricators and manufacturers of wire mill equipment.

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"OFFICIAL PUBLICATION" BY THE WIRE ASSOCIATION

Issued Monthly
75 Cents a Copy in U. S. — Per year, United States, $8.00
75 Cents a Copy in Canada — Per year, Canada, $8.00
90 Cents a Copy in Foreign Countries — Per year, Foreign, $10.50
October Convention Issue $1.25 a Copy
January Convention Proceedings Issue $1.25 a Copy

vide a coil-forming machine capable of winding coils of various sizes and designs, employing a new form of mandrel.

★ ★ ★

No. 2,868,359, WIRE-DRAWING BLOCK, patented January 13, 1959 by John A. Holbrook, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts.

More particularly the patent relates to a block in which practically all the surface of wire coiled thereon is subject to the action of cooling air without sacrifice of capstan effect.

★ ★ ★

No. 2,868,370, DEVICE FOR PACKAGING COILED MATERIAL, patented January 13, 1959 by Charles E. Franks, Waukegan, Ill., assignor to United States Steel Corporation, a corporation of New Jersey.

The patent relates to patent 2,822,086 and provides a reusable retaining hook of specific shape suitable for forming and securing a compact package of coiled wire.

★ ★ ★

No. 2,868,466, RING COILING MACHINE, patented January 13, 1959 by Herbert Hammer, Zurich, Switzerland, assignor to Meteor A.-G., Zurich, Switzerland.

The machine is for coiling wire or tape on a ring and includes a device for keeping the axes of rotation of the wire magazines parallel to the axis of symmetry of the ring profile.

★ ★ ★

No. 2,868,467, MACHINE FOR PAYING OFF AND TAKING UP WIRE ON LARGE REELS, patented January 13, 1959 by Dartrey Lewis, Trenton, N. J., assignor to John A. Roebling's Sons Corporation, Trenton, N. J., a corporation of New Jersey.

There is provided a support for supporting a number of reels for selected rotation which serves as a wire take-up reel and another of the reels serving as a wire pay-off reel.

★ ★ ★

No. 2,868,468, STRAND REELING APPARATUS, patented January 13, 1959 by Tillman T. Bunch, near Ashland, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

More specifically the invention relates to apparatus for distributing relatively thin and fragile strands uniformly upon take-up reels.

★ ★ ★

No. 2,869,220, PROCESS AND ARRANGEMENT FOR THE PRODUCTION OF CABLES AND CONDUCTORS HAVING A CORRUGATED SHEATHING, MORE ESPECIALLY A METAL SHEATHING, patented January 20, 1959 by Ulrich Raydt and Karl Heinz Hahne, Osnabruck, Germany, assignors to Osnabrucker Kupfer—und Drahtwerk, Osnabruck, Germany.

A metal sheath is loosely extruded about the cable and the latter fed to a corrugating machine in such manner that the assemblage is formed without longitudinal relative movement between the cable and the sheathing.

★ ★ ★

No. 2,869,316, TWISTED CONDUCTORS AND CABLES AND METHOD AND APPARATUS FOR MAKING THE SAME, patented January 20, 1959 by Joseph C. Lilly, Plainfield, Conn., assignor to The Plastic Wire & Cable Corporation, Jewett City, Conn., a corporation of Connecticut.

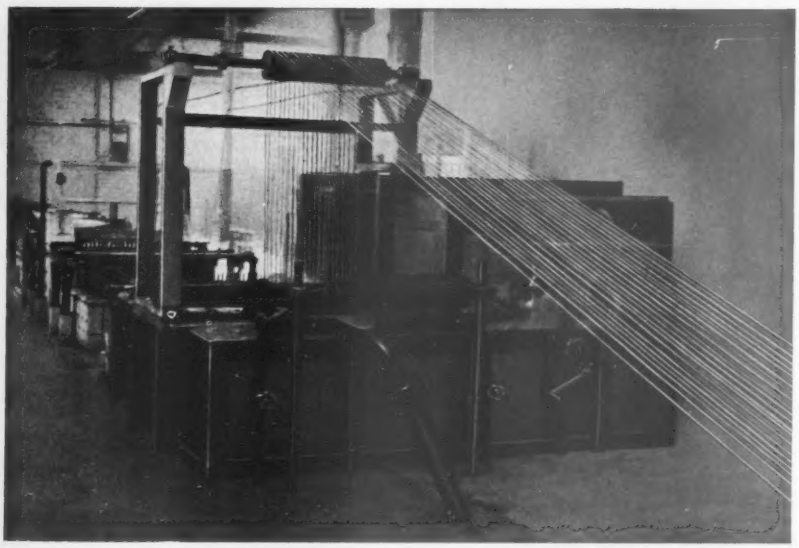
The method of forming a cable including a number of juxtaposed twisted pairs of twisted conductors comprises the steps of twisting the conductors of each pair to form twists therein, continuously and at random varying the lengths of the twists, and positioning a number of twisted pairs in side-by-side relation, the continuous and random variation of the twists in adjacent pairs causing the conductors to be transposed and in non-inductive relation whereby inductive disturbances in the cable are prevented. 14 claims.

★ ★ ★

No. 2,869,590, WIRE BENDING MACHINES, patented January 20, 1959 by Joseph H. Hoern, Saginaw, Mich., assignor to Saginaw Wire Products, Inc., Saginaw, Mich.

The machine is stated to be adapted to bend wires of great length and in which movable die slides are disposed on opposite sides of the wire to be

Galvanizing in a Ceramic Tank means saving a lot of money!



COVER HEATED galvanizing furnace for wire
(German and Foreign Patents issued)

UNLIMITED LIFE
LESS DROSS
LOW INSTALLATION COSTS

also for galvanizing
WIRE
★ HEXAGON NETTING
STRIP

Operation by Gas or Oil

SOLE REPRESENTATIVE:
PAUL REICHER
Machinery & Equipment
P.O. BOX 127
Willowdale, Ont., Canada

OFENBAU FRITZ G.m.b.H. & Co. K.G. HAGEN, (W.-GERMANY)

moved in directions to bend the wire.

★ ★ ★

No. 2,869.591, APPARATUS ADAPTED FOR THE BENDING OF WIRE STRIP MATERIAL AND THE LIKE, patented January 20, 1959 by Sam Larkin, Belle Harbor, N. Y.

A die unit is provided to effect a single bend, and includes a reciprocating member which in one stroke in one direction will close the die, open the die and retract a mandrel. During the return stroke, other dies do their work.

★ ★ ★

No. 2,869.640, TRAVELING WIRE COIL CUTTER, patented January 20, 1959 by Stephen A. Platt, Grand Haven, Mich.

In cutting electric resistance wire alloy coils the cutter is said to be adapted to cut accurately equal lengths while the coil is travelling lengthwise and rotating.

★ ★ ★

No. 2,869,719, WIRE PROCESSING AND STORAGE CONTAINER, patented January 20, 1959 by Eber J. Hubbard, Fort Wayne, Ind., assignor to Hubbard Spool Company, Garrett, Ind., a corporation of Illinois.

Spaced apart perforated drums, with the bottom wall of one, define a storage space for wire, the drum assembly being raised from a supporting surface for cooperation with the lifting forks of a lift truck or the like and to provide for circulation of fluid around material in the storage space.

★ ★ ★

No. 2,869,738, APPARATUS FOR GATHERING AND SUSPENDING TIED BUNDLES OF WIRE OR THE LIKE IN ALINED GROUPS, patented January 20, 1959 by John F. Nelson, Concord, Scott D. Warner, Pittsburg, and Robert G. Whitney, Concord, Calif., assignor to United States Steel Corporation, a corporation of New Jersey.

The apparatus is adapted to pile or arrange the wire bundles and includes a frame and a handler.

★ ★ ★

No. 2,870,526. BRASS PLATED RUBBER ADHERENT STEEL WIRE, patented January 27, 1959 by Orville E. Adler, Niles, Mich., assignor by mesne assignments, to National-Standard Company, a corporation of Delaware.

The wire is provided with a layer of zinc which is at least .00004 inch thick; and an electro-deposited-as-such layer of highly rubber adherent brass on the zinc which is at least .000017 inch thick, the brass layer immediately after deposition having a uniform ratio of copper to zinc throughout, and said to have a high degree of stability to change in its rubber adherence under adverse climatic conditions.

★ ★ ★

No. 2,870,816, DEVICE FOR BENDING COILS, patented January 27, 1959 by Raymond H. Greene, Detroit, Mich., assignor to Calumet & Hecla, Inc., Chicago, Ill., a corporation of Michigan.

A pivoted bender is provided to which the work is attached.

★ ★ ★

No. 2,870,823, SPRING STRUCTURES, patented January 27, 1959 by Lynn W. Staples, Saginaw, Mich., assignor to Saginaw Wire Products, Inc., Saginaw, Mich.

Zig-zag wire coils are provided, with end sections having loops with load-distributing bearing engagement with the frame members of the structure over substantial portions of the extent thereof.

★ ★ ★

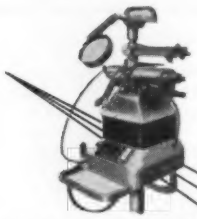
No. 2,870,974, MACHINE FOR COMPRESSING AND ROLLING BEDDING SPRINGS, patented January 27, 1959 by Alvin F. Clark, Jr., Fort Worth, Tex.

The invention relates to a hydraulically-operated tension device for such machine.

★ ★ ★

No. 2,871,151, ELECTRICAL CABLE, patented January 27, 1959 by Milton A. Lipton, West Long Branch, N. J.

A star-quad cable is formed by spirally winding an insulating material in the form of a tape of approximately 5 mil thickness about each of the four conductors in fixed spaced convolutions so that a series of interstices are formed between successive windings with the conductors disposed about a core whereby the windings of insulation about any one conductor are in abutment with and overlap separate discrete interstices formed by the windings of a conductor immediately adjacent.



MODEL "S", for Steel: .01" - .08" diam. Copper: .01" - .072" diam.

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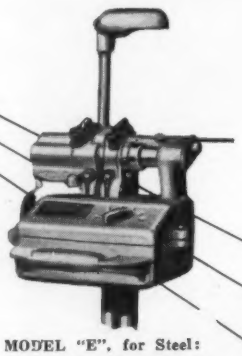

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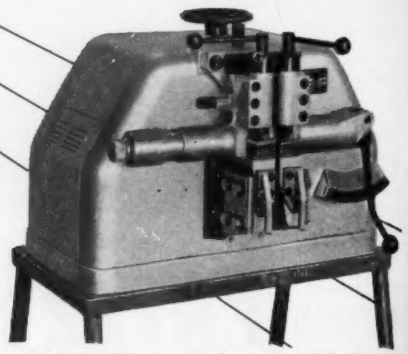

MODEL "M", for Steel: .16" - .51" diam. Copper: .16" - .37" diam.

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Bulletin on Variable-Speed Drive

A new eight-page bulletin, G-5812, describes the complete line of Reeves Variable-Speed Drives, which provide precise, infinitely adjustable output speeds from a constant rpm. motor source operating from standard in-plant a-c. circuits.

★ ★ ★

The bulletin includes mechanical construction features, condensed drive specifications, available speed variations and accessories for the Reeves Vari-Speed Motodrive, Motor Pulley and Variable-Speed Transmission.

★ ★ ★

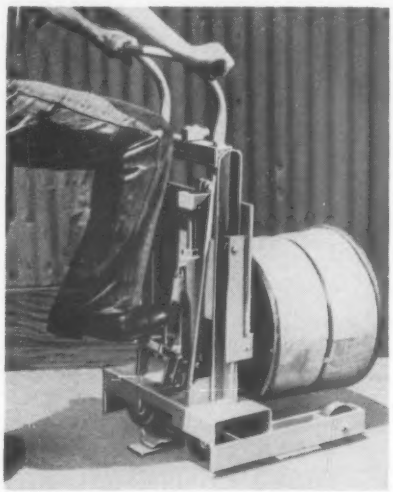
Individual copies of Bulletin G-5812 are available by writing to **Reeves Pulley Company, Division of Reliance Electric and Engineering Company, Columbus, Ind.**

Wire Reel Positioner

Designed especially to handle reels, the American Safeway Reel Positioner embodies all the features of larger, pedal-operated lift-trucks, yet eliminates unnecessary lifting height and excess weight.

★ ★ ★

The unit consists of a pedal-operated hydraulic lifting mechanism mounted on a steel frame equipped with two fixed wheels and two swivel casters. The truck has a foot brake, a locking device for holding the reel in a raised position for prolonged periods, and a handle for moving the truck.



Wire Reel Positioner. * * * * * *

★ ★ ★

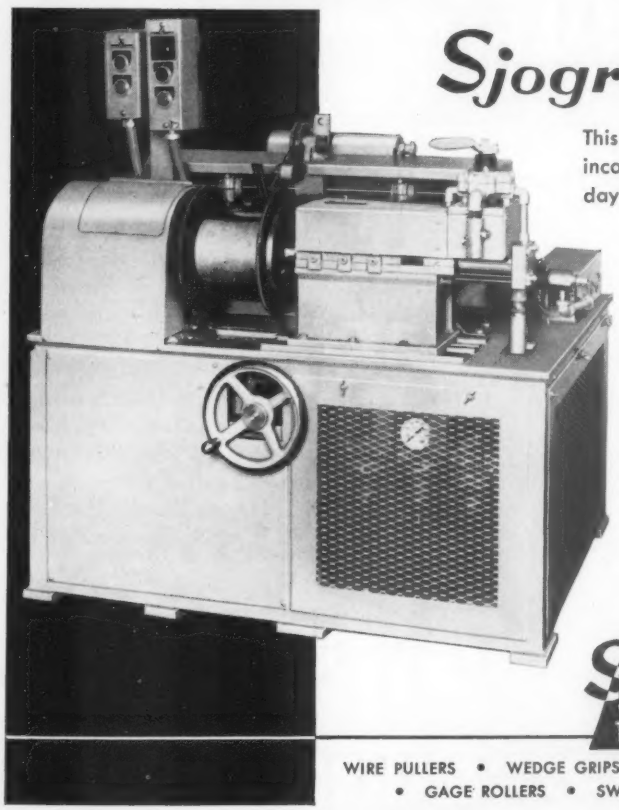
Prior to the introduction of these trucks, an expensive means of raising and positioning reels at the machine site was necessary, and much maintenance and extra manual lifting required. By using the American Wire Reel Positioner, mobility is gained, first costs reduced, life expectancy of equipment increased, and maintenance decreased.

★ ★ ★

A large number of these trucks have been put into service in an Eastern electrical equipment manufacturing plant for handling 500 pound reels of copper wire.

★ ★ ★

For details and prices, write **The American Pulley Co.**, 4200 Wissahickon Ave., Philadelphia 29, Pa.



Sjogren SPOOLER

This machine is especially designed for wire mill use and incorporates many outstanding features adapted to present day high speed production.

SPEED — When placed directly behind wire drawing machine the Sjogren Spooler is capable of spooling at 1800 fpm.

CAPACITY — 100 pound maximum.

TRAVERSE — Hydraulic traverse is infinitely adjustable from zero to 5/8" per rpm of spool.

LOADING — Loading of spool is air-actuated.

TENSION — Louis-Allis eddy current clutch type motor with potentiometer for variable tension.

STARTING — Forced acceleration circuit prevents slack wire during wire drawing machine acceleration.

BRAKING — Goodyear airplane disc type brakes.

USED BY WIRE MEN WHO WANT THE BEST!

Sjogren TOOL & MACHINE CO., INC.

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AMERICAN IRON AND STEEL INSTITUTE
150 EAST FORTY-SECOND STREET, NEW YORK 17, N. Y.

AIS 10

DECEMBER - 1958
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

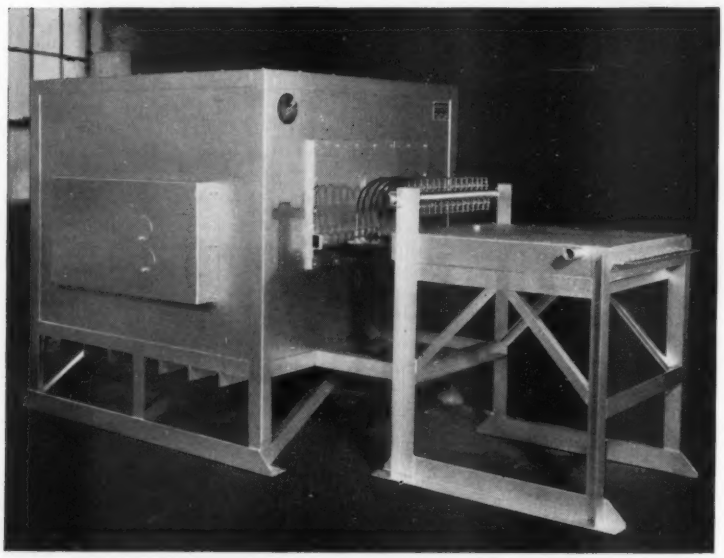
Steel Products	Items	CURRENT MONTH 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments	YEAR TO DATE * 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments
Ingots and Steel Castings	1A	11,502	12,220	1,680	25,402	0.5	0.6	133,876	115,096	18,450	267,422	0.5	0.6
Blooms, slabs, billets, sheet bars	1B	91,593	35,952	1,506	129,051	2.3	2.2	817,052	308,516	16,548	1,142,116	1.9	2.9
Tube rounds	1C	1,296	249	5	1,550	-	-	8,604	2,015	80	10,699	-	0.1
Skelp	2	6,998	-	-	6,998	0.1	0.1	113,546	-	-	113,546	0.2	0.2
Wire rods	3	82,410	2,037	603	85,050	1.6	1.3	873,705	15,304	5,927	894,936	1.5	1.2
TOTAL SEMI-FINISHED		193,799	50,458	3,794	248,051	4.5	4.2	1,946,783	440,931	41,005	2,428,719	4.1	5.0
Bars—Hot rolled (incl. light shapes)	14	447,576	128,357	3,204	579,137	10.5	8.9	4,490,036	1,122,188	34,339	5,646,563	9.4	9.3
Bars—Reinforcing	15	142,914	-	-	142,914	2.6	2.0	2,034,795	-	-	2,034,795	3.4	2.9
Bars—Cold finished	16	86,628	19,137	4,485	110,250	2.0	1.7	834,017	146,175	43,225	1,023,417	1.7	1.8
Tool steel	17	760	6,075	-	6,835	0.1	0.1	8,390	61,880	-	70,270	0.1	0.2
TOTAL BARS AND TOOL STEEL		677,878	153,569	7,689	839,136	15.2	12.7	*7,367,238	1,330,243	77,564	8,775,045	14.6	14.1
Wire—Drawn	23	199,361	3,312	2,390	205,063	3.7	3.2	2,507,890	32,459	22,592	2,562,887	3.9	3.8
Wire—Nails & staples	24	21,536	-	-	21,536	0.4	0.4	417,690	-	14	417,704	0.7	0.6
Wire—Barbed & twisted	25	2,572	-	-	2,572	0.1	-	56,031	-	-	56,031	0.1	0.2
Wire—Woven wire fence	26	5,788	-	-	5,788	0.1	0.2	157,070	-	-	157,070	0.3	0.2
Wire—Bale ties & baling wire	27	1,865	-	-	1,865	-	-	57,366	-	-	57,366	0.1	0.1
TOTAL WIRE & WIRE PRODUCTS		231,122	3,312	2,390	236,824	4.3	3.8	2,996,053	32,459	22,546	3,051,056	5.1	4.2
Sheets—Hot rolled	31	664,062	25,786	4,284	694,132	12.6	10.2	6,045,997	215,253	30,010	6,291,260	10.5	9.8
Sheets—Cold rolled	32	1,239,703	4,177	9,484	1,253,364	22.8	17.9	10,176,253	36,871	112,537	10,325,661	17.2	14.9
Sheets—Galvanized	33	266,472	-	-	266,472	4.8	3.1	2,828,844	4	-	2,828,848	4.7	3.4
Sheets—All other coated	34	25,268	-	-	25,268	0.5	0.4	190,063	-	-	190,063	0.3	0.2
Electrical sheets & strip	35	3,986	44,560	-	48,546	0.9	0.7	34,225	441,980	-	476,205	0.8	0.8
Strip—Hot rolled	36	114,979	1,821	851	117,651	2.1	1.8	1,022,080	17,444	8,640	1,048,164	1.8	1.7
Strip—Cold rolled	37	82,382	1,405	16,718	100,505	1.8	1.8	812,731	12,166	156,092	981,009	1.7	1.6
TOTAL SHEETS AND STRIP		2,396,872	77,749	31,337	2,505,958	45.5	35.9	21,110,193	723,738	307,285	22,141,216	37.0	32.0
TOTAL SHIPMENTS (1958)		5,089,597	373,042	49,730	5,512,369	100.0	xxx	56,077,092	3,343,849	493,492	59,914,433	100.0	xxx
TOTAL — PRIOR YEAR (1957)		4,732,208	325,239	35,466	5,092,913	xxx	100.0	74,531,609	4,743,213	619,755	79,894,577	xxx	100.0

*Revised.

13059

HARPER STRAND ANNEALER

delivers bright stainless wire continuously at high speeds



Operating at temperatures from 2000°F. to 2200°F., this 30 tube Harper Electric Strand Annealing Furnace turns out Type 304SS wire bright and clean. Sizes from .02" to .0014" are passed through its 40" hot zone at rates up to 100 FPM per tube.

Providing close temperature control, Harper Strand Annealers maintain extremely dry reducing atmospheres to produce a truly bright finish. Designed for dependable, trouble-free performance over long periods, they permit wire speeds up to 150 FPM per tube.

Harper manufactures a full line of automatic conveyor, continuous tube, and bell type annealing furnaces for billets, bars, rods and wire. To solve your wire problem most profitably, call in a Harper engineer or write: Harper Electric Furnace Corporation, 42 River St., Buffalo 2, N.Y

HARPER
ELECTRIC FURNACES

COPPER - Consumption of refined copper in the United States, October-November 1958, in short tons

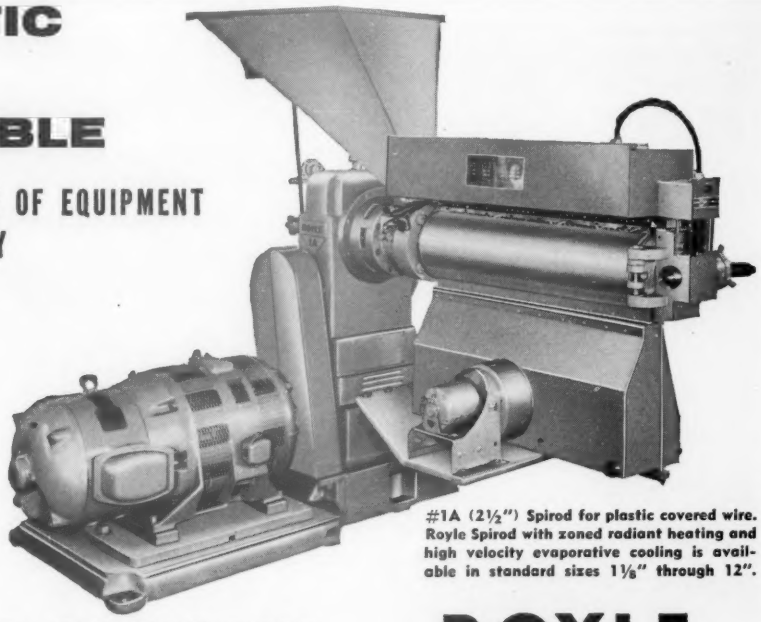
	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
October:						
Cathodes	550	10,389	(3)	33	(3)	10,972
Wire bars	76,529	6,261	(3)	-----	(3)	82,790
Ingots and ingot bars	1,298	9,271	(3)	247	(3)	10,816
Cakes and slabs	-----	12,366	(3)	8	(3)	12,374
Billets	-----	15,497	(3)	-----	(3)	15,497
Other	98	-----	(3)	38	(3)	136
Total	78,475	53,784	(4)	326	(4)	4/135,585
November:						
Cathodes	351	8,790	(3)	72	(3)	9,213
Wire bars	70,838	4,835	(3)	-----	(3)	75,673
Ingots and ingot bars	762	8,860	(3)	200	(3)	9,822
Cakes and slabs	-----	10,399	(3)	-----	(3)	10,399
Billets	-----	12,008	(3)	-----	(3)	12,008
Other	92	-----	(3)	86	(3)	178
Total	72,043	44,892	(4)	358	(4)	4/120,293

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.

FOR PLASTIC COVERED WIRE AND CABLE

ROYLE'S COMPLETE LINE OF EQUIPMENT FOR THE WIRE INDUSTRY

- PAYOFFS
- BELT WRAP CAPSTANS
- COOLING TROUGHS
- AIR WIPER ASSEMBLIES
- DUAL-WHEEL CAPSTANS
- SINGLE REEL TAKEUPS
- DUAL-REEL HI-SPEED TAKEUPS



#1A (2½") Spirod for plastic covered wire. Royle Spirod with zoned radiant heating and high velocity evaporative cooling is available in standard sizes 1⅛" through 12".

NEW:-

ROYLE WIRE HEAD

Small Volume — Controlled Flow
Easy Fixture Removal — Easy Cleanout — Self-Centering Characteristics

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NEMA Adds Members

Four additional companies have been added to the membership rolls of the **National Electrical Manufacturers Association,** it has been announced by **Joseph F. Miller,** Managing Director. They are:

* * *

Electrolux Corporation, Old Greenwich, Conn., affiliated with the Motor and Generator Section— **Robert Weeks, Jr.,** Assistant Chief Engineer, Voting Representative.

* * *

Philadelphia Insulated Wire Co., Philadelphia, Pa., affiliated with the Wire and Cable Section — **J. J. Dowling,** President, Voting Representative.

* * *

Monitor Controller Division, Industrial Electronics Company, Inc., Rockland, Mass., affiliated with Industrial Control Section — **R. J. Quinn, Jr.,** Vice President, Voting Representative.

* * *

Reynolds Metals Company, Richmond, Va., Arc Welding and Wire and Cable Sections — **Walter M. Franklin,** Director, Electrical Markets Sales, Voting Representative.

Booklet on Gas Welding Wire

Inert gas welding wire is the subject of a new booklet released by **Kaiser Aluminum & Chemical Sales, Inc.** describing the process and listing availabilities.

* * *

Known by the brand name "King," Kaiser Aluminum's spooled electrode for inert gas welding is a continuous, consumable electrode which provides the welding industry with a high quality aluminum filler wire.

* * *

The booklet also describes King filler rod used for inert-gas tungsten-arc welding. Full details concerning availabilities, packaging and care of welding wire are included.

* * *

Copies of the booklet, "Kaiser Aluminum King Welding Wire," may be obtained free from Kaiser Aluminum & Chemical Sales, Inc., Department NR-22, 919 North Michigan Ave., Chicago, Ill.

Electric Wire & Cable Section To Hold Fine Meeting in Boston

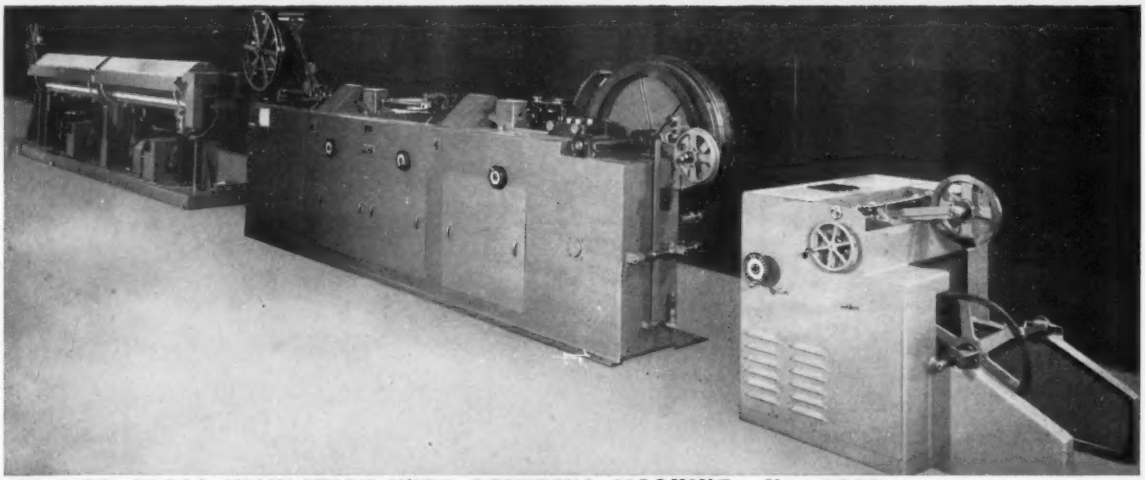
A Regional Meeting of **The Wire Association** has been arranged by the Electric Wire & Cable Committee for April 29 and 30, 1959 at the Statler-Hilton Hotel, Boston, Mass.

* * *

The meeting will hear eight technical papers on extrusion, plastic processing, and quality control, the details of which appear elsewhere in this issue (see index). Following the technical sessions on Thursday, the 30th, there will be a visit to the Cambridge plant of the **Simplex Wire and Cable Company.**

* * *

The committeemen who are re-



4D-1-BB GLASS INSULATION WIRE COVERING MACHINE No. 1088 Patented Aug. 3, 1943

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sponsible handling the details of the meeting are:

General Program Chairman

URBAIN J. H. MALO, Mgr., Product Engineering
The Crescent Co., Pawtucket, R. I.

Local Arrangements

ALFRED GARSHICK, Devel. Eng.
Boston Insulated Wire Co., Boston, Mass.

Plant Visitation

GEORGE H. HUNT, Res. & Devel. Mgr.
Simplex Wire & Cable Co., Cambridge, Mass.

Ladies Program

JOSEPH P. WINDGOOSE, Devel. Eng.
Collyer Wire & Cable Co., Pawtucket, R. I.

Social Activities

ROGER T. STAFFORD, Proj. Eng.

Kennecott Wire and Cable Div.
The Okonite Co., Phillipsdale, R. I.

Mr. Malo assumed a large part of the responsibility of securing the technical papers and **Thomas K. Cox,** Engineer—Rubber & Plastic covered wire & Cord—Chemical Processes, Western Electric Co., Baltimore, Md., and **James E. Flood,** Technical Director of Plastic Wire & Cable Corp., Jewett City, Conn., both will serve as moderators of the technical sessions.

* * *

The outlook is for a large attendance at the meeting, the first one devoted solely to the interests of the electric wire and cable producers and arranged under the auspices of the Association's Electric Wire and Cable Committee.

* * *

The cost of registration will be $12.00 for Association members and $14.00 for guests, the charge including a ticket for the banquet on Wednesday evening, April 29. The only other fee will be a charge of $2.00 per person for bus transportation to and from the Cambridge plant of the Simplex Wire & Cable Company on Thursday, April 30. Tickets for ladies' activities may be procured at the registration desk.

* * *

The meeting is designed to be of special interest to electric wire and cable men concerned with production and all such men, whether Association members or not, are cordially invited to attend.

Okonite Acquired by Kennecott

Announcement has been made of the acquisition of **The Okonite Company** by the **Kennecott Copper Corporation.** The company will hereafter be known as **"The Okonite Company, subsidiary of the Kennecott Corporation."**

* * *

Okonite has electric wire and cable manufacturing plants in Passaic, Paterson and North Brunswick, New Jersey.

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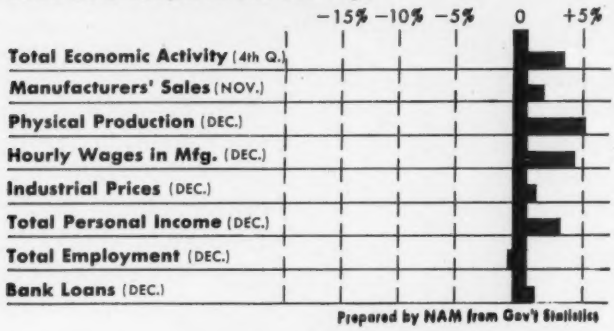
UP OR DOWN — AT A GLANCE

Latest Data Compared with Year Ago



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Bulletin on Swaging Applications

Fenn Manufacturing Co., Newington, Conn., has published a new bulletin on interesting swaging applications that is available to persons who would like information on the subject. In writing, please ask for Bulletin B-10.

Flame Retardant Polyethylene for Wire and Cable

(*Continued from page* 324)

4. Wm. B. Happoldt, Jr., "Flame-Retardant Polyethylene Compositions," U.S. 2,480,298.
5. Rudolph A. Schatzel, "Improvements in or Relating to Flame Resistant Insulated Conductors," British Patent 713,174.
6. Rudolph A. Schatzel, "Insulated Conductor Coated with Polyethylene Butyl Rubber Resin," U.S. 2,830,919.
7. ASTM D 470-56T, Testing Rubber and Thermoplastic Insulated Wire and Cable.
8. Underwriters' Laboratories, Inc. Standard for Rubber-Covered Wires and Cables.
9. Underwriters' Laboratories, Inc. Standard for Thermoplastic-Insulated Wires.
10. ASTM D 734-50T, Specification for Insulated Wire and Cable.
11. J. B. DeCoste, F. S. Malm, and V. T. Wallder, "Cracking of Stressed Polyethylene," Ind. Eng. Chem. 43, 117-21 (1951).

APPENDIX

Specification for Black Flame Retardant Polyethylene Jacket For Wire and Cable

Scope:

This specification covers a black flame retardant polyethylene compound suitable for use as the outside covering or jacket on insulated electrical wires or cables. The acceptability of the jacket compound, under this specification, shall be determined solely by the test requirements specified herein. The jacket is intended for operation between minus 55°C through plus 75°C, and for installation at temperatures not below minus 40°C. The jacket shall provide the cable with a tough, flexible, long-lived protective covering, able to withstand sunlight and atmospheric environments.

PHYSICAL REQUIREMENTS

	Values		
	Original	After Accelerated Aging Exposure	Accelerated Aging Exposure
Tensile, Min. psi	1,400	75% of unaged values	Air oven, 48 hours 100± 1°C (212°F)
Elongation at rupture, min. percent	350	75% of unaged values	Air oven, 48 hours 100± 1°C (212°F)
Heat distortion, max. percent	—	25	Air oven, 1 hour 90± 1°C (194°F)
Environmental Cracking	—	No cracks	Immersion in Cracking Agent 48 hours, 50°C ± 1°C (122°F)
Light absorptivity coefficient of light absorption, min. ...	24,000*		

* Note 1: In lieu of testing finished cable jacket a certification by manufacturer of polyethylene compound that this requirement has been complied with shall suffice.

Test Methods

Physical:

ASTM D-470; ASTM D-412 (Die C, speed 20" min. on 1" bench marks); and ASTM D-573.

Heat Distortion:

ASTM D-1047; para. 8 except 90°C rather than 121°C.

Environmental Cracking:

a. Preparation of test specimens — Test specimens approximately 1.5 inch in length, 0.5 inch wide and 0.120 inch thick shall be molded from material taken from the completed cable. A slit made with a razor blade, approximately 0.75 inch long and from 0.020 to 0.025 inch deep, shall be centrally located on one of the 1.5 inch by 0.5 inch surfaces.

b. Test procedure — The specimens shall be bent with the slit on the outside and placed in a standard test tube 150 mm long and 18 mm in diameter. The cracking agent, Igepal CA, extra high concentrate, is added to completely cover the samples. The test tube, suitably closed by means such as a foil covered cork, shall be placed in an oven at 50 plus or minus 1°C for 48 hours. At the end of this period the specimens are removed, allowed to cool to room temperature, and inspected for cracking.

Light Absorptivity:

ASA C8.35-1957, Appendix A.

Flame Resistance:

Underwriters' Laboratories horizontal flame test.

Correction

In the biographical notes on **D. D. Buchanan** published in January, 1959, on page 43. in connection with the Mordica Memorial Lecture "What the Wire Association Means to You—And What Is Ahead," it was stated that Mr. Buchanan was a life member of the American Iron and Steel Institute.

★ ★ ★

While he is a member of the AISI, he is not a life member, the Institute having no such membership category. He is, however, a life member of the American Society of Mechanical Engineers.

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- CLASS D, CABLE TO 6" O.D.
- ALSO THREE-WHEEL MODELS

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NOTICE OF MEETING

of BOARD OF DIRECTORS of

THE WIRE ASSOCIATION

In accordance with Article 5, Section 3, of the Association's By-Laws, the regular Spring meeting of the Board of Directors will be held at the Biltmore Hotel, New York City, at 9:30 A.M., Tuesday, April 28, 1959, to transact such business as may be required.

Board members who may be arriving in New York on April 27 may make hotel reservations through:

MR. PERRY MONTAYNE
Hotel Reservations
Biltmore Hotel
New York, N. Y.

Those Directors desiring to attend the Regional Meeting of the Electric Wire & Cable Section in Boston the following day, can leave after lunch by train or otherwise.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET **STAMFORD, CONN.**

These abstracts are published through the courtesy and with the permission of the Industrial Diamond Information Bureau, 2 Charterhouse Street, London, E.C.1, England. Inquiries regarding them should be directed to the Bureau.

REPAIR OF WIRE DRAWING EQUIPMENT

Ya. A. Amlinskii. Library of Congress Mthly Index Russ Access 1958 Vol 11 (7) p 2254 (Oct) (Original in Russian)

Book, Gos naucho-tekhn izd-vo lit-ry po chernoi i tsvetnoi metallurgii, Moscow. 1958, 163 pp. [Not in library of Ind Diamond Inf Bur].

RECRYSTALLISATION OF TUNGSTEN WIRES. I & II

G. L. Davis (Mullard Radio Valve Co. Ltd). Metallurgia 1958 Vol 58 (348) pp 177-184 (Oct); (349) pp 228-232 (Nov)

BORING AND POLISHING MACHINE TYPE ME 1 FOR DRAWING DIES.

Ziehstein-Bohr-und Poliermaschine Typ ME 1 S. Eder, Wien-Oberlaa, Austria. Draht 1958 Vol 9 (11) pp 468-469 (Nov)

This machine enables five operations to be performed at the same time in polishing drawing dies with wire: the rotation of the die; the movement of the wire through the die (about 80 oscillations/min); constant gradual feed of new wire; superimposed oscillations to 500, 1,000, 3,000 and 4,000 strokes/min; and automatic swinging of the die between 8 and 28°, which can be controlled by means of a scale. Boron carbide with diamond dust added is used as the polishing material for sintered-carbide dies. A table shows times taken for polishing diamond dies, and the centering device is described. 2 illustr, 1 table.

NEW TECHNIQUES IN DRAWING CHROMIUM-VANADIUM WIRE USED FOR SPRINGS

V. V. Fedorov, Ya. Kh. Sartan. Biul TSNIICHM 1958 (19) pp 48-49; Library of Congress Mthly Index Russ Access 1958 Vol 11 (7) p 2254 (Oct) (Original in Russian)

WIRE MANUFACTURE AT STOCKSBRIDGE

Samuel Fox & Co. Ltd, Stocksbridge. Wire Industry 1958 Vol 25 (299) pp 1053-1056, 1057 (Nov)

A review of plant and production methods at the Stocksbridge works. 8 illustr.

A HEAVY INTERMEDIATE WIRE-DRAWING MACHINE

Winget-Syncro Ltd, Rochester, Kent. Wire Industry 1958 Vol 25 (299) p 1048 (Nov)

The D-14 heavy intermediate wire

drawing machine handles a maximum entry size of 5/16 in. diameter soft rod, with a finishing range from 0.128 to 0.0403 in., according to the entry size. The machine can be supplied to spool only, to coil only, or to spool and coil. It can also be supplied with annealer and Reelomatic spooler for continuous spooling of annealed copper wire. The maximum finishing speed is 3,500 ft/min, and the maximum number of die positions is 14. 1 illustr.

THE CALCULATION OF DRAWING FORCE AND DIE PRESSURE IN WIRE DRAWING

P. W. Whitton (ICI). Inst Met Journ 1958 Vol 86 (9) pp 417-421 (May)

Various wire drawing theories are examined in the light of recently advanced knowledge of the values for the coefficient of friction between the drawn wire and the die. Differences amounting to ±20% between observed and predicted values of drawing force and mean die pressure are given in the most accurate theories. Theories taking account of the effect of redundant work are unstisfactory, although they constitute an improvement on those assuming homogeneous deformation. An empirical expression is presented which permits rapid calculation of drawing forces to within ±10% for both annealed and prestrained wire. 5 illustr, 14 ref, 5 tables.

AUTOMATIC CONTROL OF WIRE DRAWING MACHINES

Ya. L. Frankfurt. TSvet met 1954 Vol 27 (3) pp 55-63 (May-June); Library of Congress Mthly List Russ Access 1958 Vol 10 (10) p 2888 (Jan) (Original in Russian)

MECHANICAL EQUIPMENT OF WIRE DRAWING AND STRIP ROLLING MILLS

A. M. Kogos. Library of Congress Mthly Index Russ Access 1958 Vol 11 (3) p 620 (June) (Original in Russian)

Book, Gos nauchno-tekhn ixd-vo lit-ry po chernoi i tsvetnoi metallurgii, Moscow. 1957, 338 pp. [Not in library of Ind Diamond Inf Bur].

HEAT TREATMENT AND CLEANING IN WIRE PRODUCTION

E. Hague. Metallurgia 1958 Vol 58 (346) pp 80-83 (Aug) 8 illustr.

RELATIONSHIPS IN THE DRAWING OF METAL WIRE IN PRESENCE OF LUBRICANTS

S. Ya. Veiler, V. I. Likhtman. Dokl Akad Nauk SSSR 1957 Vol 114 (6) pp 1224-1227 (Original in Russian)

[Transl av, H. Brutcher, PO Box 157, Altadena, Calif. Price: $4.35, No 4293].

THE MANUFACTURE OF ROBERTSON ROLLING MILLS AND WIRE DRAWING MACHINES, ETC.

Anon. Brit Machine Tool Engg 1958 Vol 40 (191) pp 41-72 (Apr-June) 89 illustr.

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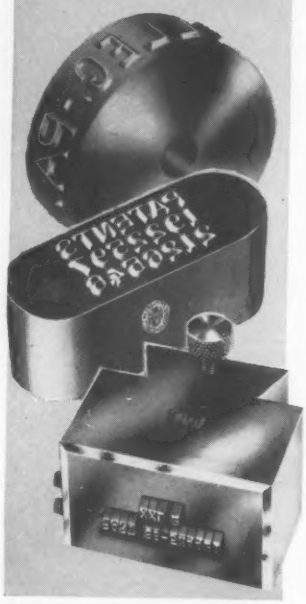

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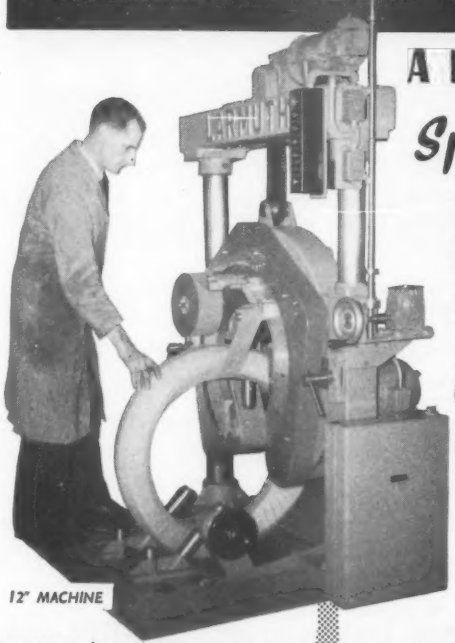

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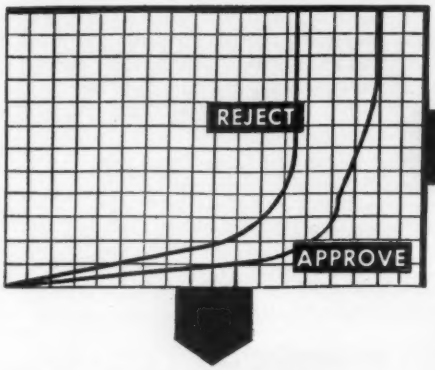

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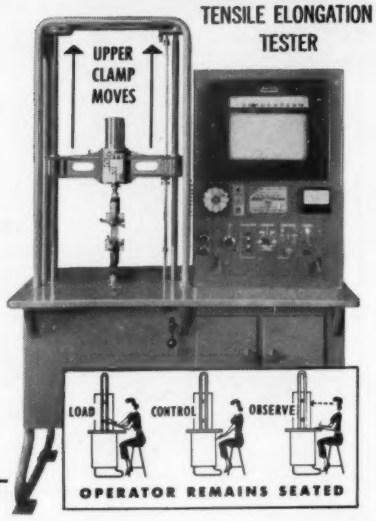

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Anon. Draht-Welt 1958 Vol 44 (17/18) p 263 (Sep) (In German)

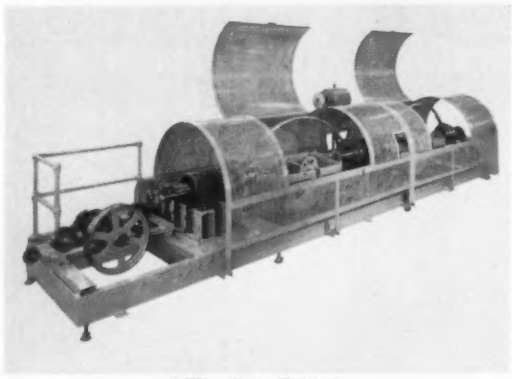
ELECTRICAL DIAMOND DIE DRILLING
Anon. Wire Ind 1958 Vol 25 (298) pp 963, 977 (Oct)

The diamond is mounted on a brass block and the primary cone drilled by means of high-voltage sparks formed at the point of a needle, 0.02 in. in diameter, in contact with the diamond. The secondary cone is formed by applying a low-voltage discharge to the diamond which is mounted on an insulating post in a dish of electrolyte; the electrolyte should just cover the diamond. The ten operations involved, following the 'squaring' of two sides of the diamond and the making of a window, are: (i) spotting, to form a cone 0.014 to 0.020 in. deep, by high voltage drilling; (ii) 30 to 40 minutes mechanical drilling with diamond powder; (iii) repetition of high voltage drilling; (iv) mechanical coning; (v) final fore-drilling which should bring the bottom of the cone to within 0.006 and 0.008 in. of the back surface of the diamond; (vi) final primary coning to produce a cone diameter of 0.002 to 0.003 in., immediately above its apex; (vii) electrolytic drilling of secondary cone, using a 5% aqueous solution of sodium chloride; (viii) drilling the main body of the secondary cone with potassium nitrate; (ix) countersinking of sharp edge; and (x) mechanical finishing and polishing.

PROGRESS IN WIRE DRAWING
Anon. Mech World etc 1958 Vol 138 (3472) pp 498-504 (Nov)

A survey of wire drawing, especially dies, lubrication, and heat treatment of the wire. A section of the article relates to diamond dies.

Diamond dies are principally used on wires below 0.10 in., but, where accuracy of diameter is not of great importance, carbide dies can be used down to 0.03 inch. The life of a diamond die is 2½ times that of a carbide die. The use of diamond as a gauge stone on carbide die drawing machines is mentioned, and the geometry of diamond dies is discussed. Other sections deal with ferrous wire, die construction, drawing speeds, drawing machines, and heat treatment. 16 illustr, 3 ref.



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★ ★ ★

The Cutter Head is equipped with a pistol grip which fits the hand and gives ease in one-hand manipulation. Power is applied through finger pressure on control button for all-position cutting. One connecting hose from cutter head to power pump gives easier han-

dling and "quick-detach" coupler allows fast changeover to any one of 3 sizes of cutter heads. For further ease in cutting, cutter heads may be suspended from a self-retracting spring balancer so that tool virtually floats over a large work area, relieving operator of all strain and speeding up cutting operations.

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Safety factors include positive locking of cutter mechanism unless control button is pushed so that cutter jaws can never be closed accidentally; low voltage control, 12 volt single phase gives safety and ease of operation; relief valve of rugged construction has large, clean oil passages and unloading pressure is set at factory.

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Three sizes of cutter jaws are available for cutting materials up to ¾", 1⅛" and 1⅜" in diameter.

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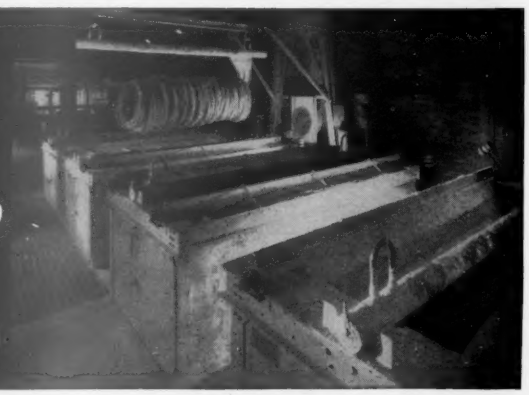

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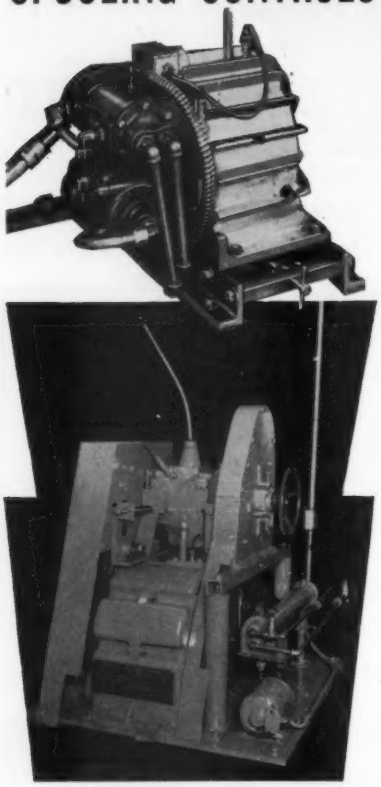

Illus.: Unit in operation on 75HP Capstan Holdback.

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New Attachments Increase The Usefulness of Spring Coilers

(*Continued from page* 332)

When the required wire feed is longer than can be produced by one stroke of the segment, successive strokes are taken till the necessary amount of wire has been fed, after which the cut takes place. Pitch and diameter camming is possible during the first half of the first stroke and the last half of the last stroke. The mechanism consists essentially of a device for counting the strokes of the segment and a means of stopping the cam shaft during the first stroke and starting it during the last stroke. After the completion of the last stroke, the cut takes place. Other advantages of the multiple feed mechanism are:

a) **Standard cams can be used.**
b) **In initially setting up and adjusting the pitch or diameter cams, only that portion of the spring requiring camming need be formed.**

The only limitation on length of the spring is the length of the building or, more practically, the length of spring that can be coiled before the weight of the spring causes a creeping increase in diameter due to frictional resistance in the trough.

Special-Purpose Machines

All of the devices described above have been attachments which can be added to a standard spring coiler to extend its range of usefulness so that more and different types of springs can be made. In contrast, Torrington has participated in the development of a variety of special-purpose machines, designed to produce one particular type of spring only.

* * *

For example, manufacture of the reinforcing spring for vacuum cleaner hose—a coil made of vinyl-covered steel wire requiring as much as 2000 in. of wire feed—require a coiling machine stripped of the pitch and diameter mechanism. The coiler had to be simple and could be comparatively light. The bench-type continuous coiler in Figure 4 was therefore constructed

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Fig. 4

of light welded steel and equipped with a vertical cutter mechanism and dumping runout trough. A limit switch in the trough, adjustable for the length of coil, actuates an electric feed clutch, the cutter mechanism, and the dumping trough. The machine comprises only enough elements to make the hose reinforcing spring.

Conclusion

Many spring makers are familiar with most of these developments. Some, in expressing their need and adapting their own spring making machines, have contributed directly or indirectly to improvements that have been built into present equipment. These improvements have been discussed briefly in this article in rough chronological order so as to bring into focus the most active period of development of the spring industry's basic production tool.

New Purchasing Agent at Sheet and Tube

Thomas G. Lewis has been appointed Purchasing Agent for the **Youngstown Sheet and Tube Company** with headquarters in the general offices, Boardman, Ohio.

★ ★ ★

At the same time, **William B. Seeman** was advanced to the position of group leader, buyer.

★ ★ ★

The appointments, effective January 1, were announced by **J. D. Sloan,** vice president—purchasing, whom Mr. Lewis succeeds.

ACCURATE TENSION CONTROL REQUIRES A

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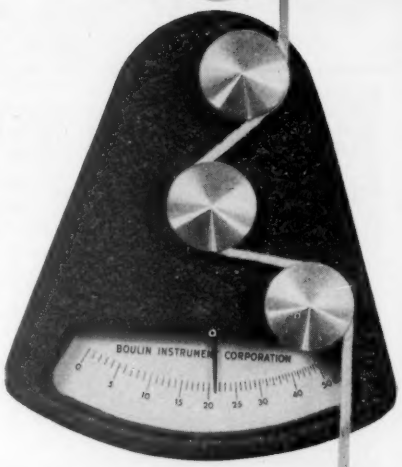

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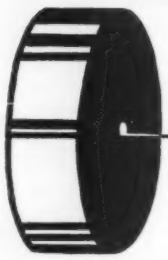

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(*Continued from page* 318)

of industrial trucks, as we still

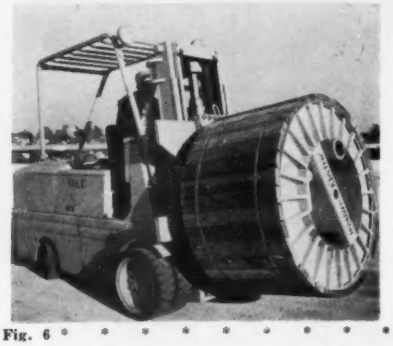

Fig. 6

believe that developments in the coming years may make it possible to reduce our present operating aisles from 14′ to some lower figure. There are a few aisles (due to the depth and diameter of the reel) which are 16′ wide, but for the most part of the storage involving the most active 78″ dia. reels, these aisles are 14′ width.

F. Results

The new storage area (See Fig. 7) has resulted in reducing the annual operating costs by $35,000 at authorized capacity levels, ($50,000 at current production levels) and the storage layout is now orderly with "lost" reels reduced to a minimum. Under present

Fig. 7

operating routines, the truck operator approaches the reel at the lagging machines; makes his pick up, moves the reel across the scale and at this point he checks for an appropriate storage location and records this information on the

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cable reel tag and places the tag in a collection box. He then drives the truck to the pre-selected storage location and deposits the reel in position. Before returning he checks the outgoing shipments to be picked up and drives to a reel that is to be selected, makes the pickup and delivers the reel to the proper platform, rail or truck. (See Fig. 8) In the case of the truck platform, each truck position has sufficient space to permit accumulation of a full truck load (which helps in reducing the loading period for each shipment). The truck driver then returns to the lagging area to pick up the next reel consigned to storage and in this manner he can always be moving with a payload.

★ ★ ★

We now move the reel to storage with one piece of handling equipment and one man instead of three men. In addition we can, when the need arises to make emergency shipments, concentrate our entire fleet of industrial trucks on making delivery of reels from storage to the shipping platform permitting the telephone companies to restore

Fig. 8 * * * * * * * * *

service with a minimum of delay. This type of quick delivery was impossible under the old plan when we had two cranes both on the same track. Our equipment maintenance costs have been greatly reduced with the removal of the cranes and we insure shipping capacity since we maintain a standby truck for the fleet of these trucks normally required for handling; furthermore, rental units are obtainable in a few hours in event we have two truck units down for service. With the locomotive cranes, loss of one unit critically impaired our shipments and the breakdown of both units would bring shipment to a complete standstill. With the use of industrial trucks as the handling medium, replacement costs have been minimized and any change in design offered by the truck industry that is economically justifiable can be accomplished without major expenditures. (Cranes cost $125,000 per unit; industrial trucks cost $8,000.)

G. Future

It is planned to equip the entire fleet of lift trucks with two-way radio to permit the supervisor to be in constant contact with all truck operators, keeping them properly loaded with work and to issue directives for changes without making a search. The Reel Yard Organization is now equipped with a snow blower for removal of snowfall and, in addition, two of the industrial trucks have snow shovels as auxiliary equipment when required to aid in snow removal, if the weather conditions indicate sleet or freezing rain, a salt spreader is immediately dispatched to salt down all aisles and this has been effective in melting

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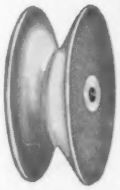

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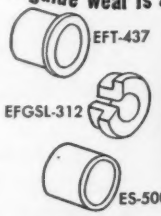

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the ice and keeping aisles open for safe travel.

H. Summary

We are now able to handle an increased load with less people resulting in lower costs, greater flexibility, less lost reels and without confusion.

Contact Stresses in Wire Ropes

(*Continued from page* 314)

method suggested by Herbst[5] to avoid this dangerous condition should be carefully considered.

* * *

At this point it would be worthwhile to examine the significance of these results. The seriousness of the contact stresses has been seen, but their effect is still to be evaluated. In all of the preceding analysis, the material has been assumed to be elastic, which obviously would not be true at high stresses. The contact stresses induced are highly local concentrated stresses which cause yielding at the points of contact. The material which reaches its yield point first will continue to deform into the plastic region. This will allow an even larger area of contact to be formed until the radial load is taken. A single application of the load would cause small impressions to appear at the points of contact, the stress distribution would change due to plastic flow, and a larger area would subsequently be presented to the radial load. However, under static tensile load the rope is not materially weakened.

* * *

If, however, the wire rope is to be subjected to a large number of cycles of this loading, the effect of this over-stressing on the fatigue properties of the material would no doubt be great. The rope would fail at a much lower number of cycles than would be predicted by the stress due to direct tension.

* * *

Another possible detrimental condition would exist if a wire rope of this type were subjected to corrosion while under either static or dynamic loading. The result of the combined effect of a high prolonged stressing and corrosive attack is known as stress-corrosion cracking. In this case, the necessity of properly protecting the cables of a span across salt water can be seen.

* * *

Still another form of corrosion known as "fretting corrosion" may exist in a wire rope. This form of corrosion has been found to exist between two metals in contact with only very slight relative movements between them. Only moderate stresses are necessary for this phenomenon to occur.

* * *

In conclusion, it is believed that the results obtained in this work are very significant as a part of the complete study of the wire rope. It is hoped that this work has given a new insight into the complex study of the stresses existing in wire ropes.

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New Kingfield Rod and Wire Works

(*Continued from page 326*)

ameter down to .048" diameter and up to 16 ft. in length. (Fig. 5).

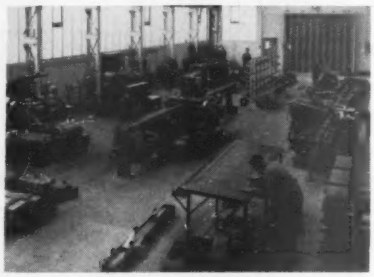

Fig. 5—Finishing and despatch bay. * *

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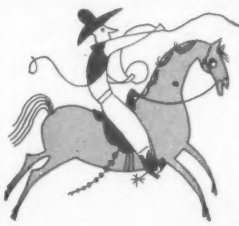

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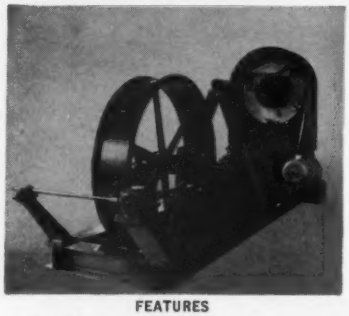

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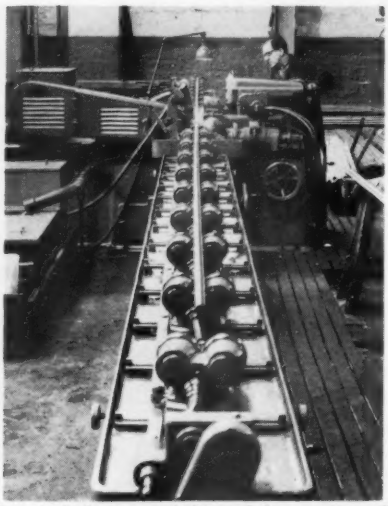

Fig. 6—Lidkoping centerless grinder.

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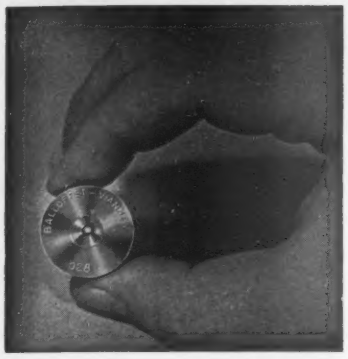

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fluorescent discharge lamps (10-400 Watt) provide artificial lighting. The whole plant has been installed by the mills' own electricians and engineers.

* * *

The materials dealt with by the firm include most En and similar specification steels. Others are silver steel, low-expansion nickel-iron alloys, high-speed steel and carbon chromium drilling rod. Heat resisting and other alloy wires are manufactured in high quality and uniformity to clients specifications.

* * *

Acknowledgement is due to Messrs. **Darwins Ltd.** of Sheffield for data and illustrations.

Swaged Terminals in Boom Pendant Applications

(*Continued from page* 335)

or three per cent of nominal loads used.

* * *

Dynamic test loads were 17,500, 20,000 and 24,500 pounds. The extremes represent 25 per cent and 35 per cent of the catalog strength of the rope used. A weight was placed in the load box or a drop height, usually five inches, was tried. By reading the oscillograph the deviations from the desired load were corrected with the test readings taken as the true load.

* * *

The loading was frequently checked and the load cell amplifier-oscillograph was also checked periodically for electrical balance. The entire load recording combination was calibrated at Lehigh University before being placed in operation.

* * *

When a specimen was in testing position under static load the cantilevered beam was leveled. As the rope stretched under testing the beam was re-leveled at intervals by means of the dead end adjusting nut.

* * *

Criterion of failure was the first complete breakage of a strand. Wire breaks at different points were generally not construed as failure until at least one strand had broken. When this occurred, the test was stopped and the number of cycles recorded.

* * *

An examination of the accompanying graph shows the considerable variation of life, depending upon the type of end fitting and the type of rope used. The increase in life along any one curve, especially any of the swaged socket curves, as the load decreased is worth noting.

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Outstanding Personalities of the Wire Association

(*Continued from page* 353)

to general manager of architectural and building products sales.

Rockbestos Appoints New Production Manager

Alfred H. Macgillivray has been appointed Production Manager for **Rockbestos Products Corporation,** manufacturers of electrical wires and cables, of New Haven, Conn., it was announced by **Albert S. Redway,** Rockbestos president.

★ ★ ★

Mr. Macgillivray has been superintendent of the Central Falls, R. I. Plant of **Collyer Insulated Wire Company** for the past ten years.

★ ★ ★

He was born in Providence, R. I., and attended the public schools and was graduated from the Providence Country Day School, and, from Brown University in 1939.

★ ★ ★

Active in community affairs in Pawtucket, R. I., he is a member of the Electric Wire and Cable Committee of **The Wire Association,** and has been an active member of the Providence Engineering Society for twenty years.

Aluminum Association Elects Officers

M. M. Anderson, Vice President of the **Aluminum Company of America,** Pittsburgh, was elected President of **The Aluminum Association** at the annual meeting in January. **S. D. Den Uyl,** Chairman of the Board, **Bohn Aluminum & Brass Corp.,** Detroit, who preceded Mr. Anderson as Association president, was elected Chairman of the Board of Directors.

★ ★ ★

Frank R. Nichols, President, **Nichols Wire & Aluminum Company,** Davenport, Iowa, and **Jesse E. Williams,** Vice President & General Manager, **Olin Mathieson**

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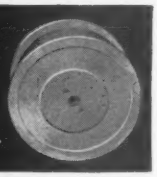

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Chemical Corp., Metals Division, New York, were elected directors-at-large for three-year terms. **C. A. Macfie**, President, **Revere Copper and Brass, Inc.**, New York, was re-elected to a three-year term as director-at-large.

* * *

Two Association Vice Presidents were elected: **John W. Douglas**, President, **Republic Foil and Metal Mills Inc.**, Danbury, Conn., and **Thomas D. Gebhart**, an Executive Vice President of **Anaconda Aluminum Company**, Louisville, Ky. **Frederick A. Merliss, United Smelting & Aluminum Co., Inc.**, New Haven, Conn., was re-elected a vice president.

* * *

The Association's commodity divisions also held sessions and elected officers. **W. E. Dunlap**, President, **Aluminum Extrusions, Inc.**, Charlotte, Mich., was re-elected Chairman of The Extruded Products Division and re-elected to represent the Division on The Association's Board of Directors.

* * *

Robert T. Farrell, President, **Fairmont Aluminum Company**, Fairmont, W. Va., was elected Chairman of The Aluminum Sheet Division and also was elected representative to the Board of the Association.

* * *

The Aluminum Rolled Bar and Rod, and Wire Division elected **David B. Miller, Aluminum Company of America**, Pittsburgh, as its Chairman and **Edward C. Manix**, Vice President & General Sales Manager, **Nichols Wire & Aluminum Co.**, Davenport, Iowa, to represent the Division on the Board.

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J. H. Konigsberg, Vice President, **Revere Copper and Brass Inc.,** New York, was re-elected Chairman of The Aluminum Foil Division, and **Howard J. Geraghty,** Division Manager of the Johnston Foil Division, **Standard Packaging Corp.,** St. Louis, Mo., was re-elected representative to the Board.

★ ★ ★

In The Aluminum Foundry Division, **John E. Fahlman,** President of **The Permold Company,** Medina, Ohio, was re-elected Chairman and **Arthur L. Fischer,** President, **Fischer Casting Co., Inc.,** Dunellen, N. J. was re-elected Vice Chairman. The Division re-elected **Edward C. Bloomberg,** President, **Monarch Aluminum Manufacturing Co.,** Cleveland, Ohio, representative to the Association's Board of Directors.

Acquires Kellogg Melting Process

Purchase of the Kellogg specialty alloy steel manufacturing business from **The M. W. Kellogg Company** by **Firth Sterling, Inc.** of Pittsburgh was announced jointly by officials of the two firms, effective February 1, 1959. Firth Sterling has acquired all patents, inventories and production facilities of the Kellogg ingot process.

★ ★ ★

Alloys produced by the Kellogg process, hitherto available only in ingot form, have been widely accepted and used in the aircraft and related industries. **Kenneth D. Mann,** President of Firth Sterling, stated that by integrating the Kellogg process with its own steel mill facilities, Firth Sterling is now offering structural alloy for aircraft and missiles, as well as high temperature alloys, which, in the opinion of many outstanding metallurgists, surpass in quality those produced by other methods. Production plans call for melting alloys in Firth Sterling electric arc furnaces. The alloys will be consumably remelted by the Kellogg process under a refining flux, producing ingots which may be forged and rolled into mill products such as billets, as well as hot and cold finished bars.

★ ★ ★

For the present, Firth Sterling will continue the operation at the present plant location in Jersey City, N. J.

Porter Acquires National Electric

As of February 2, 1959, the **National Electric Products Corp.,** Ambridge, Pa., was acquired by the **H. K. Porter Co., Inc.,** and will hereafter be known as **National Electric Div., H. K. Porter Co., Inc.**

★ ★ ★

As a result of meetings of the Boards of Directors of the two companies and a favorable response from the stockholders, substantially all of the assets of National Electric have been transferred to Porter.

★ ★ ★

The new Porter Division is headed by **Robert F. Bennett, Jr.,** as General Manager, who in this capacity reports directly to **E. H. Mann,** Porter's Vice President. The division employs some 2000 persons.

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COMPOUNDS—Phosphate Coating
Amchem Products, Inc., Ambler, Pa.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
The General Tire & Rubber Company, Akron, Ohio.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
United States Borax & Chemical Corp., Pacific Coast Borax Co. Div., New York, N. Y.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit

CUTTING TOOLS—Wire
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit.

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
Indiana Wire Die Company, Fort Wayne, Indiana
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.

Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Wire Packaging
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A. Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Galvanizing Equipment
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Harper Electric Furnace Corporation, Buffalo, N. Y.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Resistance Heating, Strand
Harper Electric Furnace Corporation, Buffalo, N. Y.
Sunbeam Equipment Corporation, Meadville, Pa.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Harper Electric Furnace Corporation, Buffalo, N. Y.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Sunbeam Equipment Corporation, Meadville, Pa.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS —
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
The General Tire & Rubber Company, Akron, Ohio.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Norco Chemical Company, Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Takemura & Co., Ltd., New York, N. Y.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Takemura & Co., Ltd., New York, N. Y.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Providence, R. I., Division of Wanskuck Co.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Chain Making
Larmuth and Bulmer, Limited, Manchester, England
Pan American Supply Company, New York, N. Y.
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Closing Rope
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden.
National Mach'y Exch (Used), New York
Steel & Wire Machinery Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn
Pan American Supply Company, New York, N. Y.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Steel Equipment Company, Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.

MACHINERY—Galvanizing Wire
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Packaging Wire
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Pin Making
Takemura & Co., Ltd., New York, N. Y.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Printing on Electric Wire
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Peschel Electronics, Inc., Towners, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spooling Tension Controls
Web Controls Corp., West Englewood, N. J.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY— Staple Making
Pan American Supply Company, New York, N. Y.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York 19, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel & Wire Machinery Co., Cleveland, Ohio
Takemura Co., Ltd., New York, N. Y.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Düsseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Kraft, J. A., Maschinenfabrik, OLPE/Westf. Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing for Dielectric Faults
Peschel Electronics, Inc., Towners, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Collins Bros. Machine Co., Wire & Cable Mach'y Div., Pawtucket, R. I.
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
National Electric Welding Machines Co., Bay City, Michigan
Schlatter, Ltd., H. A., Zollikon/Zurich

MACHINERY—Wire Weaving
Takemura & Co., Ltd., New York, N. Y.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York 19, N. Y.
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Wire and Machinery Co., Cleveland, Ohio
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Takemura Co., Ltd., New York, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Wire Forming
National Mach'y Exch. (Used), New York, N. Y.
Pan American Supply Company, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Takemura Co., Ltd., New York, N. Y.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Company, Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Machine Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
Amchem Products, Inc., Ambler, Pa.

PAPER—Insulating
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.

PLASTICS—for Wire Insulation
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Celanese Corporation of America, New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Frank Daniels & Co., New York, N. Y.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Mettler Machine Tool, Inc., New Haven, Conn.
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New York Engineering Corp., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
New York Engineering Corp., Yonkers, N. Y.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Molded Fiber Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Aluminum Company of America, Pittsburgh, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G. Hagen, (W.-Germany)

WHERE TO BUY, Continued

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TENSION METERS—for Wire
Boulin Instrument Corporation, Pelham, N. Y.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WAXES—for Insulated Wire
Cary Chemicals, Inc., New Brunswick, N. J.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.
National Electric Welding Machines Co., Bay City, Michigan
H. A. Schlatter, Ltd., Zollikon-Zurich

WHEELS—for Printing on Electric Wire
Frank Daniels & Co., New York, N. Y.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—Aluminum
Aluminum Company of America, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Clad and Plated
Sylvania Electric Products Inc., Warren, Pennsylvania

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Malin & Co., The, Cleveland, Ohio
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Aluminum Company of America, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
Montgomery Co., The, Windsor Locks, Conn.
National Standard Company, Niles, Mich.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
Aluminum Company of America, Pittsburgh, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's John A., Sons Corp., Trenton, N. J.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Malin & Co., The, Cleveland, Ohio
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

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ESTABLISHED 1845

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ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

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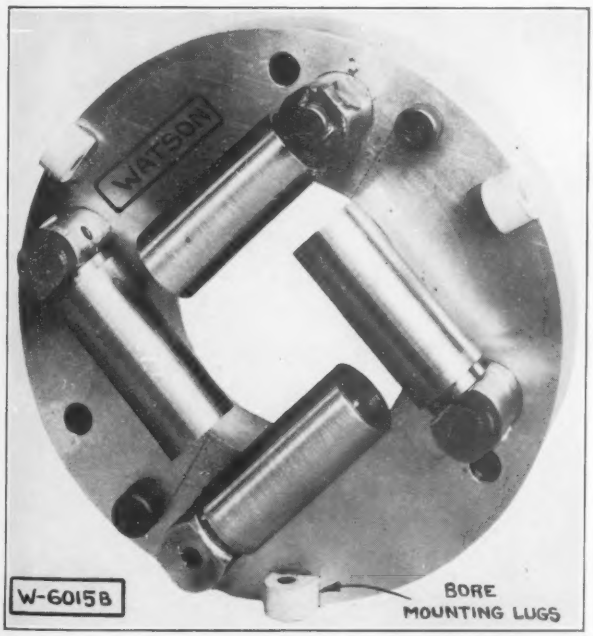
MOUNTS ON RODS OR
AGAINST FLAT FACE.



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ANTI-FRICTION ROLLS,
MOUNTS ON RODS, AGAINST
FLAT FACE OR INSIDE
OF 8.125" BORE.

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- Wire ranges from #26 to #36 B&S. Speeds up to 5000 F.P.M.
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